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FEDERAL COMMITMENTS REGARDING USED FUEL AND HIGH-LEVEL WASTES

PREPARED FOR:
BLUE RIBBON COMMISSION ON AMERICA'S NUCLEAR FUTURE

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AEA	Atomic Energy Act of 1954
AEC	Atomic Energy Commission
ASLB	Atomic Safety and Licensing Board (NRC)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EA	Environmental Assessment
EIS	Environmental Impact Statement
ERDA	Energy Research and Development Administration
FFCA	Federal Facility Compliance Act of 1992
FY	Fiscal Year
HLW	High-level radioactive waste
HEU	Highly enriched uranium
INL	Idaho National Laboratory
IWTF	Integrated Waste Treatment Facility
ICC	Interstate Commerce Commission
LLNL	Lawrence Livermore National Laboratory
LANL	Los Alamos National Laboratory
LAW	Low-activity and mixed waste
LEU	Low enriched uranium
MTHM	Metric Tons Heavy Metal
NARUC	National Association of Regulatory Utility Commissioners
NEPA	National Environmental Policy Act of 1969
NNSA	National Nuclear Security Administration (DOE)
NNPP	Naval Nuclear Propulsion Program (DOE)
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982
NWF	Nuclear Waste Fund
OCRWM	Office of Civilian Radioactive Waste Management (DOE)
EM	Office of Environmental Management (DOE)
NMSS	Office of Nuclear Material Safety and Safeguards (DOE)
RERTR	Reduced Enrichment for Research and Test Reactors
RCRA	Resource Conservation and Recovery Act of 1976
ROD	Record of Decision
SWPF	Salt Waste Processing Facility
SRS	Savannah River Site
STB	Surface Transportation Board
SRG	State Regional Groups
TM	Transportation Manual
TRU	Transuranic radioactive waste
WIPP	Waste Isolation Pilot Plant
CBO	U.S. Congressional Budget Office
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency

FEDERAL COMMITMENTS REGARDING USED FUEL AND HIGH-LEVEL WASTES

EXECUTIVE SUMMARY

At the request of the Blue Ribbon Commission Staff, Van Ness Feldman examined the following question: What commitments has the Federal Government made to states, communities, private companies, and others related to the disposal of used fuel and high-level wastes?

Spent nuclear fuel (referred to herein as "used fuel") and high-level radioactive waste ("HLW") are the by-products of commercial nuclear energy generation, defense production of nuclear weapons materials, and research and medical activities that utilize nuclear reactors or fission product nuclides. The following table provides an overview of the inventories of used fuel and HLW in the United States.

Table 1. Overall Used Fuel and HLW Inventory.

Material	Approximate Quantity (2010)
Commercial Used Fuel	~ 65,000 MTHM[1]
DOE-Managed Used Fuel	~ 2,458 MTHM[2]
DOE-Managed High Level Waste	~ 8,000 – 17,000 MTHM[3]

The Federal Government has a variety of commitments related to the cleanup and stabilization of used fuel and HLW. Ultimate disposal of these wastes has long been considered a Federal responsibility.

This paper describes the Federal Government's legal obligations related to used fuel and HLW from: (1) Commercial Reactors; (2) U.S. Department of Energy ("DOE")-Managed Sites; and (3) Foreign and Domestic Research Reactors. The paper also describes Federal transportation commitments related to used fuel and HLW.

I. COMMERCIAL REACTORS SUMMARY

In 1982, Congress enacted the Nuclear Waste Policy Act ("NWPA").[4] The NWPA made geologic disposal a national policy and established the Federal Government's responsibility for the permanent disposal of used fuel and HLW. It also made clear that the cost of such disposal would be the responsibility of the generators and owners of such waste and used fuel. The NWPA lays out the process for selecting, siting, licensing, and constructing a repository for permanent disposal, which the 1987 amendments to the NWPA limited to Yucca Mountain, Nevada.

The NWPA established the Nuclear Waste Fund ("NWF") and authorized DOE to enter into Standard Contracts with commercial reactor licensees. During the 1980's, DOE entered into 76 such contracts. Under the Standard Contract, DOE agreed to dispose of used fuel and HLW, in return for a payment of fees to the NWF (1 mil ($0.001) per kilowatt hour ("1mil/kWH")), beginning not later than January 31, 1998. The NWPA also provided that the Nuclear

Regulatory Commission ("NRC") may not issue or renew a commercial reactor license without a Standard Contract in place. In 2008, DOE amended the Standard Contract for new reactors. Under the amended Standard Contract, DOE is not required to complete disposal of the used fuel until 20 years after the expiration of the reactor's operating license and any extensions thereto.

Despite DOE's statutory and contractual deadlines to begin accepting used fuel and HLW for delivery to and disposal at a permanent repository no later than January 31, 1998, no permanent repository has yet been licensed by the NRC. As of June 2010, 72 lawsuits have been filed by utilities against DOE for missing the 1998 contractual deadline. The U.S. Government's estimated liability for judgments and settlements currently stands at approximately $2 billion, of which approximately $750 million has been paid to date. Under current law, all payments must be made out of the U.S. Department of Treasury's Judgment Fund.

DOE estimates that its potential liability related to the breach-of-contract cases could reach approximately $13.1 billion, assuming a projected date of 2020 for DOE acceptance of fuel for disposal. If that projected 2020 date is delayed, the potential breach-of-contract liability amount could increase by approximately $500 million annually.[5] Because most of the major recurring issues have been resolved in litigation and the outcomes are increasingly predictable, the Federal Government is exploring the possibility of reaching a standard settlement or using an administrative claims process with utilities with pending claims.

II. SITES MANAGED BY THE DEPARTMENT OF ENERGY SUMMARY

For many years, the AEC and then DOE produced used fuel and HLW for national defense and other programmatic missions. During most of that period, the United States did not have the environmental regulatory structure or cleanup technologies that exist today. Today, DOE's remediation activities at the various contaminated sites are mainly governed by the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"),[6] the Resource Conservation and Recovery Act ("RCRA"),[7] the National Environmental Policy Act ("NEPA"),[8] and the Federal Facility Compliance Act ("FFCA").[9]

In 1989, DOE established the Office of Environmental Management ("EM") to clean up the legacy of five decades of nuclear weapons development and government-sponsored nuclear research. In addition to the statutes noted above, DOE's cleanup work at most sites is governed by one or more regulatory agreements or orders that set forth schedules, milestones, and cleanup processes. As described in greater detail below, DOE is legally obligated to remove all used fuel from the State of Idaho by 2035.[10] No removal dates that DOE regards as legally enforceable are in place for used fuel or HLW in other States.[11]

<u>DOE-Managed Used Fuel</u>

DOE's used fuel was mainly produced at the Hanford Site ("Hanford"), the Idaho National Laboratory ("INL"), and the Savannah River Site ("SRS"). Numerous other sites also produced smaller quantities of used fuel, including Oak Ridge National Laboratory, Brookhaven National Laboratory, and various universities. Hanford, INL, and SRS are the primary storage locations for DOE used fuel. DOE manages used fuel from defense and non-defense activities. Defense

materials include used fuel from DOE production reactors and research reactors. Non-defense materials include core debris from the Three Mile Island Unit No. 2 reactor; commercial power demonstration projects (*i.e.*, Shippingport, Peach Bottom, Fort Saint Vrain); domestic research reactors; and foreign research reactors.

Table 2. DOE Used Fuel Inventory: Defense and Non-Defense.[12]

DOE Facility	Quantity of Used Fuel (in MTHM)	Description
Hanford, WA	2, 130 *Defense: ~ 2,102* *Non-Defense: ~ 27*	• Diverse inventory of used fuel include both DOE-origin and commercial used fuel. • Diverse storage facilities, including both numerous dry storage methods and wet storage pool.
Idaho National Lab, ID	280 *Defense: ~ 36* *Non-Defense: ~ 246*	• Diverse inventory includes both DOE-origin and commercial used fuel. • Diverse storage facilities include wet storage pool and numerous dry storage methods. • Sodium-bonded used fuel stored and may require treatment. • INL will continue to receive foreign research reactor (until 2019) and domestic research reactor used fuel. ***Batt* Settlement Agreement** • **Used fuel into dry storage by Dec. 31, 2023.** • **Used fuel out of Idaho by Jan. 1, 2035.** • **Penalty for missed deadline is payment to State of $60,000/day (subject to appropriations) and potential suspension of used fuel receipts into Idaho.**
Fort St. Vrain, CO	15 *Defense: 0* *Non-Defense: 15*	• Used fuel in NRC-licensed dry storage facility. • Decommissioned commercial scale high-temperature gas-cooled reactor plant. **Agreement** • **Used fuel out of Colorado by Jan. 1, 2035.**
SRS, SC	~ 30 *Defense: ~ 19* *Non-Defense: ~10*	• Used fuels contained in wet storage. • Disposition alternatives for aluminum-clad used fuel under consideration. • Current plan to receive used fuel from foreign research reactors (until 2019) and domestic research reactors.
Other Sites	2 *Defense: <1* *Non-Defense: ~2*	• Oak Ridge National Laboratory, Brookhaven National Laboratory and the National Institute of Standards Testing.
Total	**~ 2,458** ***Defense: ~ 2,149*** ***Non-Defense: ~ 309***	

DOE-Managed HLW

DOE's HLW (as well as low-activity and mixed waste ("LAW")) consists of 88 million gallons of tank waste located in 230 underground storage tanks at Hanford, SRS and INL. One of DOE's most significant environmental, safety and health threats, tank waste is also the most expensive to process and clean up.[13] DOE's current plans call for processing HLW into stable long-lasting glass-type materials or other solid waste forms at various sites and then storing it until accepted at a geologic repository.[14] **Table 3** describes DOE's key HLW obligations.

Table 3. Key DOE Obligations Related to HLW.[15]

Site	Canisters	Tank Waste (gal.)	Tanks	Agreement
Hanford, WA	0 existing ~ 9,700 projected	53 million	177	• **"Tri-Party Agreement" between DOE, EPA and Washington State.** • Sets forth dates for vitrification of HLW. • Requires retrieval of all single-shell tanks by 2040 and completing treatment of tank waste by 2047 (pending DOE change request). • Removal of HLW from site by date certain not established.
Savannah River, SC	~ 2,900 existing ~6,300 projected	33.1 million	49	• Construction of Salt Waste Processing Facility at site to treat and separate the tank waste. • Federal Facility Agreement, Site Treatment Plan, and Consent Order in place. ➢ Requires DOE to maintain canister production sufficient to remove all waste from tanks by 2028. ➢ No date certain set to require the removal of HLW from the site.
Idaho National Lab, ID	0 existing ~ 3,590 - 5,090 projected	0.9 million	4	• ***Batt* Settlement Agreement signed Oct. 1995.** • DOE must take specified steps for treatment and storage of HLW. • DOE will treat remaining sodium bearing wastes in the Integrated Waste Treatment Facility, which is currently under construction.
West Valley Demonstration Project, NY	275	600,000	Tank waste converted into 275 glass canisters	• West Valley Demonstration Project Act of 1980 makes DOE responsible for solidifying the HLW, disposing of waste created by the solidification (contingent upon the State of NY entering into and paying fees pursuant to a Standard Contract for HLW disposal with DOE), and decommissioning the facilities used in the process. • Vitrification plant was constructed and converted all of the tank waste into 275 canisters of glass-type materials. • Canisters of vitrified HLW on West Valley site until a geologic repository is available.
TOTAL	**~ 3,175 existing** **~19,865 –**	**90 million gal. tank waste**		

	21,365 projected	**8,000-17,000 MTHM total HLW**		

Naval Nuclear Propulsion Program and Idaho Obligations

The Naval Nuclear Propulsion Program ("NNPP"), an integrated program carried out jointly by the Department of the Navy ("Navy") and DOE, generates additional used fuel from the operation of naval reactors. Although Naval used fuel is a very small percentage of DOE used fuel, unlike other sources, production is ongoing. Upon removal from naval reactors, Naval used fuel is stored at INL. It must be removed from Idaho by 2035.

Special Nuclear Material Obligations

In addition to DOE's obligations related to HLW and used fuel, some special nuclear materials, including uranium contained in used fuel assemblies, may ultimately be stored in a geologic repository. In many cases, DOE has not yet issued a record of decision governing processing and ultimate disposition of these materials.

III. FOREIGN AND DOMESTIC RESEARCH REACTORS SUMMARY

Foreign Research Reactors

Under the "Atoms for Peace" program established in the 1950s, the United States began entering into bilateral agreements with other nations to provide nuclear technology for non-weapon applications in exchange for commitments by the recipient nations not to develop nuclear weapons. As a part of the program, the United States first leased and later sold to other nations the highly enriched uranium ("HEU") fuel then required to fuel research reactors. Under the lease agreements, used fuel would be returned to the United States.

In 1964, the United States established the "Off-Site Fuels Policy," which continued the policy that the United States would accept used fuel of U.S. origin (including sold fuel) for temporary storage and separation.[16] Under the Policy, U.S. acceptance of used low-enriched uranium ("LEU") fuel and used HEU fuel ended in 1992 and 1988, respectively.

In 1978, the United States created the Reduced Enrichment for Research and Test Reactors ("RERTR") Program to reduce the danger of proliferation by promoting the conversion of research reactors from HEU to LEU. Many foreign reactors made the conversion to LEU fuel contingent upon the continued willingness of the U.S. to accept used fuel.

In 1996, the United States adopted the Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel ("Nuclear Weapons Nonproliferation Policy"), under which U.S. acceptance of spent fuel of U.S.-origin was reinstated through May 12, 2009. The eligible material, then in storage at or anticipated to be generated and discharged by 107 reactors in 41 countries, was estimated to be equivalent to 19.2 metric tonnes of heavy metal

("MTHM") of used nuclear fuel (contained in up to 22,700 individual fuel elements) and up to an additional 0.6 MTHM of target material.

In 2004, DOE extended the foreign reactor used fuel acceptance policy for an additional ten years (through May 12, 2019) for eligible fuel that was irradiated by May 12, 2016. The extension was justified on the grounds that, as of 2004, the United States had received only approximately 35% of the eligible material due to slower than expected fuel usage, alternative arrangements for used fuel processing, and technical delays in the development of the LEU fuels needed to allow HEU reactors to convert.

In 2009, DOE further modified the foreign reactor used fuel acceptance policy to extend the U.S. used fuel acceptance policy to include "gap material" not covered under the existing policy. "Gap material" was defined as material that poses a threat to national security, is susceptible for use in an improvised nuclear device, presents a high risk of terrorist threat, and lacks access to another pathway to mitigate the security threat. The gap material is to be safely stored at SRS pending disposition. The acceptance of gap material is not estimated to affect the original estimates for the quantity of foreign used fuel that could be transferred to the United States under the Nuclear Weapons Nonproliferation Policy. Most foreign reactor fuel is stored at INL, and is required to be removed from that site by 2035.[17]

Domestic Research Reactors

The federal government also accepts spent fuel from domestic research reactors, of which 41 are currently operational. Van Ness Feldman was unable to determine from publicly available documents the quantity of waste that has been or will be generated by domestic research reactors that the United States is responsible for treating and storing.

IV. FEDERAL TRANSPORTATION COMMITMENTS SUMMARY

DOE's transportation program for used fuel and HLW is complicated because it is decentralized and involves a large number of parties in both government and the private sector over which DOE has limited control. There are numerous transportation commitments memorialized in Standard Contracts, transportation protocols, and transportation plans, but specific information – such as the number of shipments, possible routes, time frame, quantity, and type of material being shipped – is not readily available because it is considered by DOE to be too sensitive to be made public.

DOE transportation of used fuel and HLW is governed by a number of Federal, state, and local statutes and regulations.[18] The principal regulatory agencies for the transportation of used fuel and HLW are the U.S. Department of Transportation ("DOT") and the NRC. DOT is responsible for regulating the safety of commercial shipments of radioactive material under several statutes, including the Department of Transportation Act[19] and the Hazardous Materials Transportation Act.[20] The NRC is responsible for licensing and regulating the transfer of special nuclear materials under the Atomic Energy Act of 1954 ("AEA") and the Energy Reorganization Act. Any challenges by DOE (or any other agency of the government) to rates or practices of the freight railroads would have to be brought before the Surface Transportation Board ("STB"),

nominally a part of DOT, because, under 49 U.S.C. 10501(b), the STB has "exclusive" jurisdiction over the transportation of freight by railroad.

States and local governments also play important roles in used fuel and HLW transportation. States have a responsibility to enforce DOT highway safety regulations concerning Federal motor carrier safety and hazardous materials transportation. All 50 States and the District of Columbia retain responsibility for regulating carrier safety and emergency response issues.[21]

DOE's role in the transportation process is described in the Agency's Transportation Manual ("TM"). The TM standardizes the process and framework of DOE's radioactive material shipments by establishing 14 transportation practices. DOE Headquarters organizations oversee the transportation activities for their respective Offices. The Headquarters organizations responsible for shipping include EM; the Office of Nuclear Energy ("NE"); the Office of Science ("Science"); the Office of Civilian Radioactive Waste Management ("OCRWM"); and the National Nuclear Security Administration ("NNSA").

OCRWM is currently responsible for transporting the used fuel and HLW of NRC licensees. (Note, however, that DOE has proposed to terminate OCRWM in the DOE FY 2011 Budget.) In 2009, OCRWM issued a National Transportation Plan that describes the elements of the national transportation system that OCRWM is developing, the phases of that development effort, and how OCRWM will collaborate with stakeholders in the development and implementation of that system.[22] According to the Plan, DOE anticipates shipping to a repository 63,000 MTHM from commercial used fuel, 2,333 MTHM of DOE and NNPP used fuel, and 4,667 MTHM of DOE HLW.

FEDERAL COMMITMENTS REGARDING REMOVAL OF USED FUELS AND HIGH-LEVEL WASTES

INTRODUCTION

At the request of the Blue Ribbon Commission Staff, Van Ness Feldman examined the following question: What commitments has the Federal Government made to states, communities, private companies, and others related to the disposal of used fuel and high-level wastes?

I. COMMERCIAL REACTORS

A. Background

The Atomic Energy Act of 1954 ("AEA") created the framework for the development and regulation of nuclear materials and facilities in the United States. The AEA established a licensing requirement for civilian uses of nuclear materials and facilities, and authorized the Atomic Energy Commission ("AEC"), the predecessor agency of the NRC, to set standards regulating those uses. As originally enacted, the AEA vested title to all domestic special nuclear materials (including nuclear fuel) in the AEC as agent for the U.S. Government.[23] However, subsequent amendment removed all references to U.S. Government title for special nuclear fuels.[24]

Nearly three decades later, the U.S. Congress enacted the NWPA to address the issue of nuclear waste. The NWPA created the current structure for nuclear waste disposal in the United States by directing the U.S. Government to create a permanent repository for used fuel and HLW using funds derived from a 1 mil/kWh fee on civilian nuclear power generation. The AEA mandates that the repository be licensed by the NRC before it may be constructed. In addition, the AEA established the OCRWM within DOE to implement the program. Although the AEA originally authorized DOE to consider multiple sites for the location of the permanent repository, later amendments prohibited DOE from considering for the location of the repository any site other than Yucca Mountain in Nevada.[25]

The NWPA addressed the involvement of Federal agencies other than DOE in the development of the permanent nuclear waste repository. For example, the NWPA provided that the U.S. Environmental Protection Agency ("EPA") promulgate generally applicable environmental standards to protect "the general environment from offsite releases from radioactive material in repositories."[26] The NWPA directed DOE to consult with EPA, and obtain the concurrence of the NRC, on the development of siting guidelines governing the repository, subject to approval by the NRC.[27] Issues related to the transportation of used fuel and HLW to the repository are governed by rules promulgated by both the NRC and DOT.[28]

B. The Standard Contract

NWPA Section 302 authorized DOE to enter into contracts with nuclear power generators "for the acceptance of title, subsequent transportation, and disposal of [high-level radioactive] waste or spent fuel."[29] DOE implemented this authority by promulgating the "Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste" ("Standard Contract").[30] The Standard Contract is a generic contract governing used fuel and HLW disposal throughout the civilian nuclear power generation industry. All civilian reactors have entered into a Standard Contract as a result of separate NWPA provisions that prohibit the NRC from using its authority to issue or renew a license to a nuclear power generating facility under the AEA unless the facility is under contract for the disposal of the related used fuel and/or HLW (or the Secretary of Energy certifies that the licensee is negotiating in good faith with DOE).[31]

The Standard Contract provides the terms and conditions by which DOE is to take title to and dispose of used fuel and HLW produced by generators. Under the contract, the generator is required to pay the 1 mil/kWh fee on generation in return for DOE's commitment to "accept title to all [used fuel] and/or HLW, of domestic origin, generated by the civilian nuclear power reactor(s)."[32] Title passes from the generator to DOE at the utility site and DOE is solely responsible for the used fuel and HLW upon passage of title, including for providing transportation from the site and permanent disposal in the repository.[33] As required by the NPWA, the Standard Contract provides for those obligations to begin, "after commencement of facility operations, not later than January 31, 1998."[34]

Recognizing that the civilian nuclear power generation industry was likely to produce more used fuel and HLW each year than the permanent repository could accept, the Standard Contract contains provisions (known as the "queue") detailing the order in which DOE is to take to title to the used fuel and HLW from the various generators under contract. These provisions provide that "acceptance priority shall be based upon the age of the used fuel and/or HLW as calculated from the date of discharge . . . from the civilian nuclear power reactor."[35] This ranking criterion only applies to used fuel and HLW from operating facilities.

While the Standard Contract provides that waste from reactors that are no longer operating may be advanced in the priority ranking,[36] DOE has repeatedly declined to exercise its discretion to give priority to used fuel and HLW from non-operating facilities. DOE explained that this is due to "issues of equity [that] may result from this reallocation of waste acceptance capacity."[37] DOE has consistently advised parties seeking such priority treatment to avail themselves of the exchange provisions of the Standard Contract that allow utilities to exchange approved delivery commitments, subject to DOE approval.[38]

DOE amended the Standard Contract in 2008, in light of the ongoing unavailability of a permanent repository.[39] The changes apply to all contracts signed after the date of the amendment. As discussed above, the terms of the original Standard Contract obligate DOE to begin to dispose of used fuel and HLW beginning "not later than January 31, 1998."[40] Under the revised Standard Contract for new reactors, DOE would "not be required to complete disposal of the spent fuel until 20 years after the expiration of the operating license and any extensions thereto."[41]

With the payment of fees their primary responsibility under the contract, utilities have made significant financial contributions to date toward the construction of a permanent repository. These fees are collected in the NWF. According to information provided by DOE to the U.S. Congressional Budget Office ("CBO"), through the FY 2009 utilities have paid approximately $17.1 billion into the NWF.[42] Combined with the interest from U.S. Treasury bonds purchased with those funds, the total amount credited to the NWF through FY 2009 was $31.0 billion.[43] Going forward, the NWF balance is expected to increase by approximately $2.0 billion annually through a combination of $800 million in contributions from utilities and $1.2 billion in interest.[44] At the end of FY 2010, CBO projects the unspent balance of the NWF will be $25.4 billion.

Standard Contract Queue

According to the Standard Contract, DOE must issue an annual acceptance priority ranking for receipt of used fuel and/or HLW at the DOE repository. Article IV of the Standard Contract provides: "This priority ranking shall be based on the age of used fuel and/or HLW as calculated from the date of discharge of such material from the civilian nuclear power reactor. The oldest fuel or waste will have the highest priority for acceptance, except as provided in paragraphs B and D of Article V and paragraph B.3 of Article VI hereof."

- Paragraph B of Article V describes a delivery commitment schedule that the Purchaser (*i.e.*, the civilian nuclear power reactor) must submit for approval to DOE. Paragraph B of Article V provides the Purchaser "the right to adjust the quantities of [used fuel] and/or HLW plus or minus (+/-) twenty percent (20%), and the delivery schedule up to two (2) months, until the submission of the final delivery schedule.
- Paragraph D of Article V provides that "[e]mergency deliveries of [used fuel] and/or HLW may be accepted by DOE before the date provided in the delivery commitment schedule upon prior written approval by DOE."

Article VI addresses how to prioritize acceptance when the delivery commitment schedules for used fuel and/or HLW exceed the annual capacity of DOE's facility (or facilities). Article VI repeats the same "oldest fuel first" language of Article IV, but provides two exceptions:

- One exception is based on the emergency exception of Paragraph D of Article V.
- The other exception is based on discretionary authority to provide priority to reactors that are no longer operational. Article VI (B)(1)(b) provides: "Notwithstanding the age of the [used fuel] and/or HLW, priority may be accorded any [used fuel] and/or HLW removed from a civilian nuclear power reactor that has reached the end of its useful life or has been shut down permanently for whatever reason."

C. Factors Delaying the Establishment of a Repository

For its part, DOE did not meet the Standard Contract's January 31, 1998 deadline to begin accepting used fuel. Over a decade after the deadline, DOE has yet to open a permanent

repository or commence taking title to used fuel and HLW.[45] The delay in construction at Yucca Mountain has been attributed to a number of factors, such as:

- Budget Constraints
- Litigation Over EPA's Radiation Standard
- License Withdrawal Attempt

1. *Budget Constraints*

Some have argued that the delay has resulted from insufficient budget appropriations for the Project. Although the NWF holds a substantial sum dedicated to the construction of the permanent repository, the NWPA prohibits DOE from spending those funds unless the expenditure has been authorized in advance by a Congressional appropriation.[46] Congressional appropriations for the Yucca Mountain Project have been consistently less than the amounts requested by DOE.[47]

2. *Litigation Over EPA's Radiation Standard*

Legal challenges regarding EPA health and safety standards for the Yucca Mountain Project have also affected the Project. In 2004, the U.S. Court of Appeals for the D.C. Circuit ("D.C. Circuit") invalidated a 2001 EPA rule that established public health and safety standards for the Yucca Mountain Project based on a 10,000 year-compliance period.[48] By forcing EPA to re-start the rulemaking process to develop new standards, this decision delayed DOE's ability to apply for NRC licensing of the Project because compliance with EPA's rules is a predicate for issuance of an NRC license for the repository.

3. *License Withdrawal Attempt*

Most recently, the NRC's exercise of its authority under the NWPA to license the construction of a repository has been interrupted by the Obama Administration's decision to terminate the Yucca Mountain Project. In January 2002, the Secretary of Energy formally recommended to then-President Bush that a geologic repository could be sited at Yucca Mountain.[49] On June 3, 2008, with the approval of the Bush Administration, DOE submitted a license application to the NRC for operation of a permanent storage repository at Yucca Mountain.[50] Reversing the Bush Administration's policies, on March 3, 2010 the Obama Administration's DOE submitted a Motion to Withdraw the license application for Yucca Mountain with prejudice. The motion was submitted to the Construction Authorization Board, a three-member administrative panel of the Atomic Safety and Licensing Board ("ASLB") responsible for initially considering the Yucca Mountain license application.[51]

On June 29, 2010, the ASLB denied DOE's Motion to Withdraw. The next day, the full Commission of the NRC took the unusual step of inviting briefing from all parties – without having been asked to do so by any party – on the issue of whether the Commission should review the ASLB's decision, and if so whether it should reverse or uphold the Board's decision.[52]

All parties submitted initial briefs on these questions by July 9, 2010, and supplemental briefs by July 19, 2010. In addition, several parties to the proceedings filed a motion to recuse or disqualify three of five of the Commissioners on the grounds of bias and prejudgment.[53] One Commissioner, Commissioner Apostolakis, recused himself from the proceedings, but on other grounds.[54] The other two Commissioners separately denied the motion to recuse themselves.[55] Accordingly, the matter of whether to review the ASLB's decision and if so whether to uphold or overturn the decision denying the Motion to Withdraw is currently pending before the remaining four Commissioners of the NRC. (A 2-2 decision would leave the ASLB decision as the final agency decision.) It is not clear when the NRC will act, but it is likely to be within the next few months.

While the NRC proceedings were pending, a petition for a writ of mandamus related to DOE's Motion to Withdraw was filed in February 2010 by Aiken County, South Carolina in the D.C. Circuit Court of Appeals.[56] Aiken County argued that DOE's stated intention to withdraw its license application and its actions to shut down current operations at Yucca Mountain violate DOE's Congressionally-mandated duty under the NWPA. Aiken County also contended that the President's and Secretary of Energy's decision not to execute the legislative mandates of the NWPA constitute a violation of the separation of powers mandated by the U.S. Constitution. Similar petitions were also filed by the State of South Carolina, the State of Washington, and three individuals living near the Hanford Site.[57] These cases have been consolidated. Following the NRC's request for briefings on the ASLB's decision, the D.C. Circuit granted a Motion to Vacate the expedited briefing schedule and ordered the case be held in abeyance pending further proceedings before the NRC.[58] The Court instructed the parties to file status reports every thirty days. The first status report from DOE and other parties was filed August 27, 2010. Subsequent reports have been filed monthly.

D. Standard Contract Litigation

DOE's failure to meet the statutory and contractual deadlines to begin disposal of used fuel and HLW no later than January 31, 1998, has resulted in a wave of lawsuits and settlements, along with a continually increasing financial liability for the Federal Government.

The litigants generally assert that DOE has partially breached the Standard Contract by failing to begin operating the repository by the deadline.[59] The plaintiffs have sought damages for costs related to DOE's breach. The following is a list of major decisions interpreting DOE's obligations and liabilities under the Standard Contract:

1. *Liability Independent of Repository Operations*

Indiana Michigan Power Co. v. U.S. Dept. of Energy[60] – In 1996, a group of utilities and state regulatory commissions filed the first actions against DOE related to its nuclear waste disposal obligations. Concerned about DOE's ability to satisfy its statutory duties, the petitioners had requested that the agency address its responsibilities under the NWPA and the Standard Contract. In its "Final Interpretation of Nuclear Waste Acceptance Issues," DOE stated that it "did not have an unconditional statutory or contractual obligation to accept high-level waste and used fuel beginning January 31, 1998, in the absence of a repository or interim storage facility constructed

under the NWPA."[61] The D.C. Circuit invalidated DOE's interpretation of the NWPA on the basis that DOE's NWPA Section 302(b) duty to begin to dispose of the used fuel no later than January 31, 1998 is independent of its Section 302(a) obligation to take title to the used fuel after the commencement of repository operations. However, the Court found it premature to determine the remedy for a breach because the January 31, 1998 deadline had not yet passed. Accordingly, the Court vacated the Secretary's decision and remanded the case for further proceedings.

2. *The "Unavoidable Delay" Defense*

Northern States Power Co. v. United States[62] – Following *Indiana Michigan*, DOE stated that it would be unable to begin accepting used commercial fuel and HLW by the January 31, 1998 deadline. A group of utilities and state regulatory commissions sought a writ of mandamus to compel DOE to comply with the decision by accepting waste by the deadline. DOE asserted that the delay was unavoidable and that, under the terms of the Standard Contract governing "unavoidable delays," no relief was available. The D.C. Circuit found that the petitioners had a right to relief and that DOE had an obligation to act. Nevertheless, the Court held that the Standard Contract provided potentially adequate relief for untimely performance and, accordingly, denied the request that it issue an order compelling DOE to take the used fuel. Instead, the Court issued a limited order consistent with its decision in *Indiana Michigan* prohibiting DOE from arguing in future litigation that the delay was "unavoidable" because DOE has not yet completed a permanent repository or interim storage facility. The U.S. Court of Appeals for the Federal Circuit ("Federal Circuit") followed the D.C. Circuit's holding in early 2010.[63] As a result, DOE is barred from using the "unavoidable delay" defense.

3. *Exhaustion of Administrative Remedies*

Maine Yankee Atomic Power Co. v. United States[64] – On appeal from a U.S. Court of Federal Claims decision permitting a group of utilities to bring suit against DOE for partial breach of the Standard Contract without pursuing administrative remedies, DOE argued that its failure to meet the statutory deadline was at worst an avoidable delay for which the Standard Contract provides equitable relief. Thus, DOE argued, the utilities' claims arose under the Standard Contract and were governed by the Standard Contract's Dispute Clause, which required the utilities to seek relief through an administrative proceeding. Finding the equitable relief provided for in the Standard Contract to be inadequate, the Federal Circuit rejected DOE's arguments and permitted the utilities' case to proceed. The holding opened the door for all utilities to file damages claims against DOE in the U.S. Court of Federal Claims without first seeking relief through the Agency's administrative process.

4. *The Nature of the Damages*

Indiana Michigan Power Co. v. United States[65] – The Federal Circuit found that while utilities could recover pre-breach mitigation expenses and any post-breach costs incurred as a result of the breach, utilities could not recover future damages because DOE was only in "partial" breach of the Standard Contract. Consequently, utilities filing suit against DOE may recover only the costs incurred up to the time the lawsuit is filed and must file subsequent claims to recover future damages. The U.S. Court of Federal Claims is the court of subject matter jurisdiction in cases

involving claims for damages against United States. Because claims before the Court of Federal Claims are subject to a six-year statute of limitations, utilities must file actions within six years of incurring damages.

Ala. Power Co. v. U.S. Dept. of Energy[66] – Pursuant to a settlement agreement with various utilities, DOE agreed to reduce the utilities' future payments to the NWF through an "equitable adjustment." After the utilities challenged the offset arrangement, the Eleventh Circuit ruled that the uses of NWF funds are statutorily limited by the NWPA and that judgments against DOE under the Standard Contract cannot be paid directly or indirectly (*i.e.*, through an equitable adjustment) out of the NWF. As a result, payments by DOE for breach of the Standard Contract are paid out of the U.S. Department of Treasury's Judgment Fund.

5. *Settlement*

An alternate avenue for resolution of the claims against DOE under the NWPA has been settlement. The first settlement occurred July 19, 2000 between DOE and Exelon subsidiary PECO Energy Co. Under the terms of the fleet-wide settlement, DOE agreed to pay Exelon $80 million for past damages related to the breach. In return, Exelon agreed to make annual submittals to DOE to recover for storage costs for each subsequent year. Any disputes over reimbursable claims are subject to arbitration. Duke entered into a similar fleet-wide settlement in 2007 and, as of mid-2010, the total number of settlements has risen to 11, with approximately $760 million paid out by the United States in settlements and one affirmed judgment (in the amount of $35 million, to the Tennessee Valley Authority).[67]

6. *Litigation Status*

In total, through July 2010, 72 lawsuits have been filed against DOE for its failure to perform under the Standard Contract.[68] As noted above, 11 cases have settled with 10 others dismissed, and one affirmed judgment of $35 million.[69] Fifty cases remain pending and a number of those are subject to post-trial motions. Six "second-round" suits have been filed by utilities that previously filed claims. Federal liability to date for all settlements and judgments to date is approximately $1.3 billion. CBO expects, based on DOE estimates, that costs will reach approximately $13.1 billion through 2056 if DOE begins accepting used fuel and HLW by 2021.[70]

Because most of the major recurring issues have been resolved in litigation and the outcomes are increasingly predictable, the Federal Government is exploring the possibility of reaching a standard settlement or using an administrative claims process with utilities with pending claims.

In April 2010, the National Association of Regulatory Utility Commissioners ("NARUC") and Nuclear Energy Institute ("NEI") filed petitions in the D.C. Circuit challenging the continued collection of nuclear waste fees by DOE in the face of the agency's decision to abandon the development of a permanent repository at Yucca Mountain.[71]

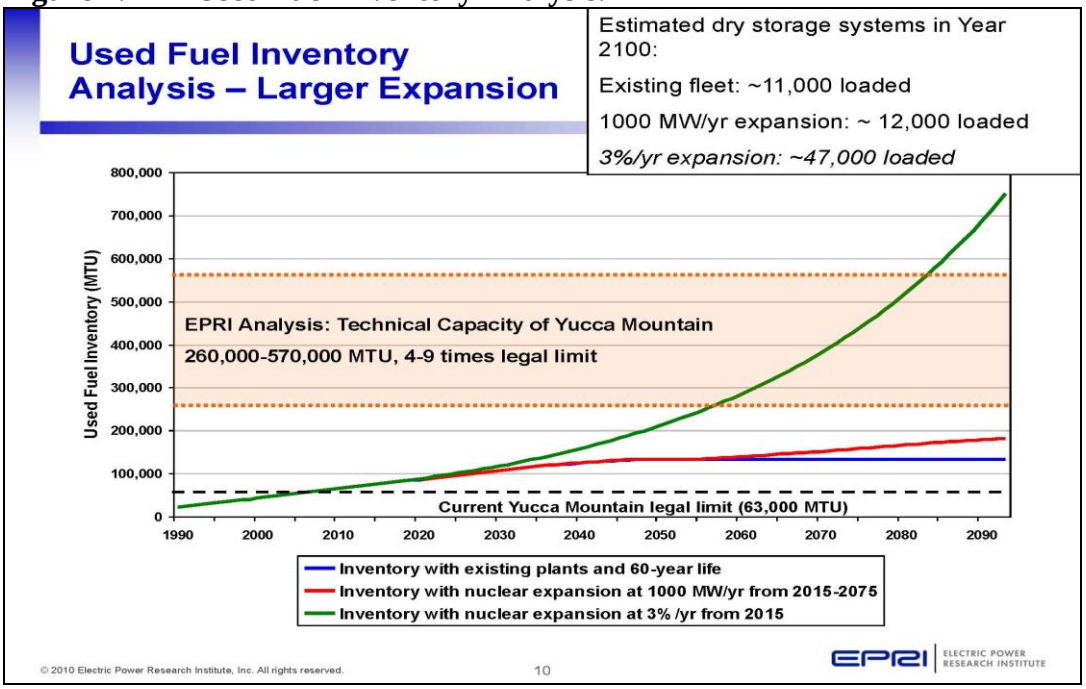
E. Current Inventory

As of August 2010, the only viable storage option for utilities is to continue storing used fuel on-site (although private storage could become an available option). The following table describes the current and projected inventories of commercial used fuel.

Table 4. Commercial Used Fuel Inventories: Current and Projected.[72]

	End of 2009	Scenario A No New Nuclear/ 60 yr plant life	Scenario B Limited Expansion: +1,000 MWe /yr beg. 2015	Scenario C Larger Expansion: 3% capacity growth/yr beg. 2015
Number of Sites	~70	~70	>70	>>70
In-pool ("wet") storage	170,000 assemblies.	Likely no pools in operation.	-	-
Dry storage	52,000 assemblies in 1,200 storage casks. 20 different dry storage designs in use.	~11,000 casks. All spent fuel stranded at decommissioned sites.	~12,000 casks	~47,000
Metric tons of Uranium	63,000 MTU	133,000 MTU	~180,000 MTU	~750,000 MTU

Figure 1. Used Fuel Inventory Analysis.[73]



II. SITES MANAGED BY THE DEPARTMENT OF ENERGY

A. Background

The nuclear era in the United States began in 1942 when the U.S. Army Corps of Engineers established the Manhattan Engineer District to manage the Manhattan Project and the development of the atomic bomb.[74] Several years later, the Atomic Energy Act of 1946 created the AEC to control nuclear energy and weapons development and to explore peaceful uses of nuclear energy.[75] The Atomic Energy Act of 1946 also made the AEC the legal owner of all fissionable materials within the United States;[76] authorized it to control military applications of atomic energy, including research and development and production of atomic weapons;[77] and bequeathed to it all of the U.S. Government's interest in the facilities and equipment devoted to atomic energy research, including Manhattan Project facilities.[78] Thus, the U.S. Government became legally responsible for these materials.

On January 1, 1947, the AEC took over from the Manhattan Engineer District the large research and production facilities built during World War II to develop the atomic bomb.[79] The requirements of national defense during the Cold War era superseded the original goal of developing peaceful nuclear applications, and for two decades military-related programs dominated the AEC's time and budget.[80] At its peak, the AEC controlled 16 major facilities, including large tracts of land in the States of Nevada, Tennessee, Idaho, Washington, and South Carolina. Its facilities ranged from tracts of isolated desert in Nevada, where weapons were tested, to warehouses in downtown New York that stored uranium. AEC national laboratories in New Mexico and California designed weapons using components produced in Colorado, Iowa, Missouri, Ohio, Tennessee, and Texas.[81]

The Atomic Energy Act of 1954 significantly amended the 1946 Act. Notably, the AEA permitted civilian access to nuclear technology and special nuclear materials for the first time.[82] The AEA also authorized the United States to exchange nuclear technology with other nations, and eased restrictions on the use of fissionable materials by the power industry.[83]

On August 26, 1964, President Lyndon B. Johnson signed the Private Ownership of Special Nuclear Materials Act, thereby allowing the nuclear power industry to take title to the fuel for its units. Under the Act, private ownership of uranium fuel in private reactors became mandatory after June 30, 1973.[84]

On October 11, 1974, Congress passed the Energy Reorganization Act of 1974,[85] which divided the AEC's functions between two new agencies: the Energy Research and Development Administration ("ERDA"), which received authority for conducting research and development activities, and the NRC, which became responsible for regulating nuclear power. This arrangement was short-lived, and, in 1977, President Carter signed the Department of Energy Organization Act,[86] which transferred all ERDA functions and obligations to the new Department of Energy.

1. *Cleanup of Environmental Contamination*

Decades of nuclear weapons production and energy research by the AEC, and later DOE, generated large amounts of HLW, used fuel, and excess plutonium and uranium, among other

waste materials.[87] During most of that time the United States had little of the environmental regulatory structure and few of the nuclear waste cleanup technologies that exist today. As a result, these materials were stored and disposed of in ways now considered unacceptable.

Under the modern environmental statutory regime, the U.S. Government holds title to these materials and is responsible for cleaning up and ultimately disposing of much of these wastes, as well as remediating any contaminated sites. DOE's cleanup and remediation activities, under the direction of DOE's EM, are primarily governed by the following statutes:

- CERCLA – Governs the uncontrolled releases or threatened releases of certain substances to the environment and the cleanup of inactive waste sites.

- RCRA – Provides for the management of regulated hazardous waste and requires DOE to obtain permits for its facilities that treat, store, or dispose of hazardous waste or mixed waste.[88] RCRA also requires corrective action to address releases of hazardous contaminants. RCRA specifically excludes source, special nuclear, or by-product material (as defined by the AEA) from the definition of solid waste.[89]

- NEPA – Requires that Federal agencies consider the environmental effects of major Federal actions significantly affecting the human environment in the decision making process. After completion of an Environmental Assessment ("EA") or an Environmental Impact Statement ("EIS"), the Federal agency issues a Record of Decision ("ROD") documenting its final determination based on its environmental analysis. RODs are official agency policy, but can be amended or revised at any time upon additional review or analysis.

- FFCA – Waives sovereign immunity with respect to RCRA for Federal facilities.[90] Provisions of the FFCA also: 1) allow states to collect fines, penalties, and oversight fees from Federal entities; 2) require EPA or authorized States to conduct yearly RCRA inspections at Federal facilities and to seek reimbursement from those facilities for all inspection costs; and 3) require DOE to evaluate the inventory of radioactive mixed wastes it currently controls and to investigate present and future treatment capacity and technologies for the management of DOE mixed wastes.

Additional Background on FFCA

Before the passage of the FFCA, the Federal Government maintained that it was not subject to administrative and civil fines and penalties under solid and hazardous waste law under the doctrine of sovereign immunity. The State of Ohio challenged the Federal Government's claim to sovereign immunity in *Ohio v. Dept. of Energy*.[91] Finding for the State, the Sixth Circuit determined that the Federal Government's sovereign immunity was waived under both the Clean Water Act's sovereign immunity provision and RCRA's citizen suit provision (but not RCRA's sovereign immunity provision). Although the Supreme Court later overturned the Sixth Circuit's decision,[92] Congress ultimately brought Federal facilities into the same legal framework as the private sector through passage of the FFCA, which mooted the Supreme Court's ruling.

2. *Agreements to Remediate Facilities*

Beyond the statutes discussed above, DOE's cleanup work also is often governed by one or more regulatory agreements or orders. These agreements and orders can take various forms, including Federal Facility Agreements,[93] consent orders and agreements, settlement agreements,[94] consent decrees,[95] or site treatment plans.[96] While varying in their specific form and the nature of their authority, these agreements and orders establish the scope of work to be performed at a given site and the dates by which specific cleanup milestones must be achieved.[97]

In many cases, however, the cleanup and remediation milestones are at risk of not being met or have already not been achieved, despite the fact that target dates for future cleanup action were set with the understanding that preliminary work was needed to characterize the extent of the contamination.[98] Often, waste and material management activities at DOE require close inter-site coordination; yet milestones developed at sites did not always consider the effect of schedules at other sites.[99] Additionally, some negotiated milestones assumed that certain technological challenges would be solved to support achievement of the milestone. In many cases, the technological challenges have been greater than originally thought.

Storage for DOE-managed Used Fuel and HLW
In 1985, President Reagan decided, pursuant to Section 8 of the NWPA, to dedicate disposal capacity of the first geologic repository to the disposal of used fuel and HLW resulting from national defense activities, including from the DOE and U.S. Navy.[100] Accordingly, DOE has been allocated 7,000 MTHM[101] of the Federal Repository's total capacity of 70,000 MTHM for both its used fuel and HLW.[102] As of January 2009, DOE had approximately 2,400 MTHM of used fuel and between 8,000 and 17,000 MTHM of tank waste.[103] Unless more capacity becomes available, the Nation will need a second repository for used fuel and HLW, and DOE will be required to store outside the repository the excess above its allocation.[104] To address this situation, the Second Repository Report suggests the following possible solutions: (1) Remove the statutory limit of 70,000 MTHM and dispose of currently projected quantities of used fuel and HLW at the repository; (2) Begin the process of siting, designing, licensing and constructing a second repository; or (3) Defer the decision and prolong the time commercial used fuel generated after 2010 will be stored at reactor sites, as well as the time DOE used fuel and HLW will be stored at DOE sites.[105]

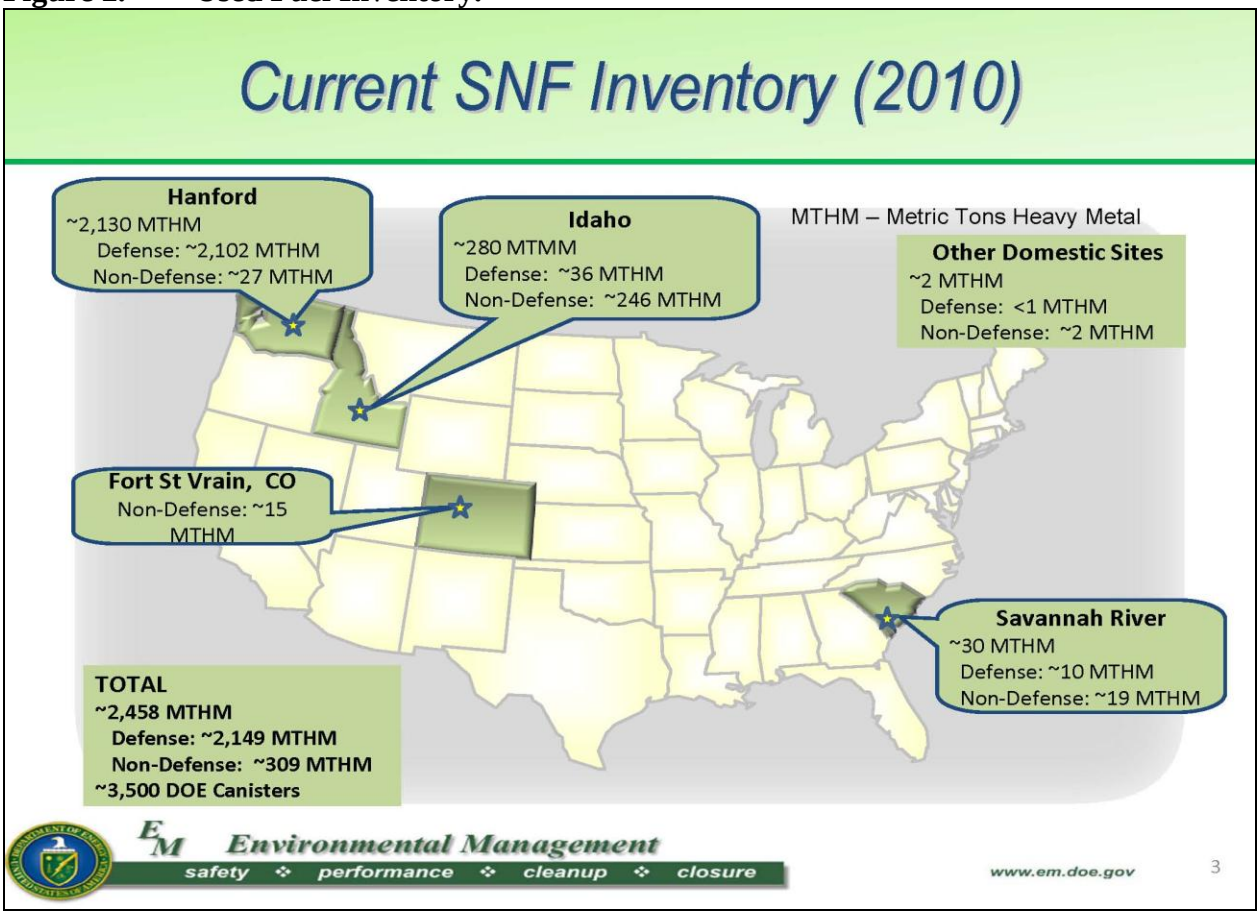
B. Used Fuel Disposal Obligations from Federal Activities

1. *Quantity and Storage of Used Fuel*

DOE manages approximately 2,400 MTHM of used fuel.[106] Most of DOE's used fuel, approximately 2,129 MTHM, is located at the Hanford Site.[107] Used fuel is currently stored in an above-ground dry cask system, with a design life of 40 years.[108] An additional 275 MTHM of used fuel is stored at INL.[109] This material consists of 150 MTHM of commercial fuel, including core debris, from Three Mile Island Unit No. 2, as well as 56 MTHM of sodium bonded fuels from the Experimental Breeder Reactor II, Fast Flux Test Facility, and Fermi reactors.[110] The remaining 74 MTHM at INL comes from a variety of defense, government research, and commercial demonstration programs, including from Naval reactors (*see* Sec. II.B.2) and foreign

and domestic research reactors (*see* Sec. III). INL also oversees the storage of 15 MTHM of used fuel at the Fort Saint Vrain facility in Colorado pursuant to a settlement agreement with the former owner of the commercial plant.[111] SRS stores an additional approximately 29 MTHM of used fuel, the majority of which are assemblies from domestic and foreign research reactors.[112] Other sites, including Oak Ridge National Laboratory, Brookhaven National Laboratory, and the National Institute of Standards Testing, store the remaining approximately 2 MTHM of used fuel held in DOE-managed sites.[113] (*See* **Figure 2** and **Table 5**, below, for additional information.)

Figure 2. Used Fuel Inventory.[114]



2. *Idaho Used Fuel Obligations*

INL stores used fuel generated by DOE sites, foreign research reactors and university reactors, and the Naval Nuclear Propulsion Program ("NNPP"), as well as remnants of the used fuel from Three Mile Island-Unit 2 and small amounts of spent fuel received from private companies that directly support DOE research and development activities.[115] The 1995 *Batt* Settlement Agreement between the State of Idaho, DOE, and the Navy governs storage at INL.

The *Batt* Agreement allows DOE to ship a limited quantity of used fuel to INL for interim storage over a 40-year period.[116] The Agreement also obligates DOE to move all used fuel into dry storage by 2023 and to remove all used fuel from Idaho, including fuel from the DOE and foreign and domestic research reactor programs, by no later than 2035.[117] If DOE fails to

remove all used fuel by 2035, the State may levy a fine of $60,000 per day.[118] If DOE fails to meet any of the *Batt* Settlement Agreement milestones at any point, the State may ask the U.S. District Court to halt any further used fuel shipments to the INL.[119]

The NNPP is an integrated program carried out jointly by the Navy and DOE that generates used fuel from the operation of naval reactors. All used fuel produced by the NNPP is stored in Idaho at INL. The *Batt* Agreement originally placed many of the same obligations and requirements on Navy as it did on DOE. A 2008 Addendum to the Agreement, however, modified the Navy's obligations regarding interim storage at INL. Under the Addendum, the Navy must still limit the number of shipments it may make to INL for interim storage over the 40-year period, but it is allowed to continue wet storage beyond 2023, to store a maximum quantity of 9 MTHM of Naval used fuel at the site beyond 2035 for a timeframe reasonably necessary for preparation for eventual removal from Idaho, and to retain archival samples of used fuel at the site to support designs that are in-service or under development.[120]

3. *Used Fuel Obligations Under Other Agreements*

Pursuant to a Colorado settlement agreement, DOE is to remove all used Fort Saint Vrain fuel from Colorado by 2035.[121] Although the obligation to remove the used fuel by that date is not, in DOE's opinion, legally binding, the agreement provides, subject to prior Congressional appropriation, for a $15,000 per day penalty to be paid to the State for each day after January 1, 2035 that the fuel is not removed. In addition, because used fuel is not regulated pursuant to RCRA or CERCLA, those statutes as implemented by EPA do not impose deadlines on DOE or DOD for removal of used fuel. Moreover, neither the Washington Tri-Party Agreement nor the South Carolina Savannah River Federal Facility Agreement contains obligations or milestones tied to the removal of used fuel from those States.

4. *Transuranic Radioactive Waste: Waste Isolation Pilot Plant*

In 1979, Congress authorized the Waste Isolation Pilot Plant ("WIPP") in Carlsbad, New Mexico to demonstrate the safe disposal of transuranic radioactive waste ("TRU Waste") from defense activities of the Federal Government. WIPP is a geologic repository sited approximately 2,150 feet below the surface in a massive formation of rock salt that provides permanent disposal for transuranic waste from defense activities. WIPP began disposal operations in 1999 and is the world's only operating deep geologic repository for radioactive waste. However, neither used fuel nor HLW are eligible for disposal as TRU waste at WIPP.

Table 5. DOE Used Fuel Inventory: Defense and Non-Defense.[122]

DOE Facility	Quantity of Used Fuel (in MTHM)	Description
Hanford, WA	2, 130 *Defense: ~ 2,102* *Non-Defense: ~ 27*	• Diverse inventory of used fuel include both DOE-origin and commercial used fuel. • Diverse storage facilities, including both numerous dry storage methods and wet storage pool.
Idaho National Lab, ID	280	• Diverse inventory includes both DOE-origin and commercial used fuel.

DOE Facility	Quantity of Used Fuel (in MTHM)	Description
	Defense: ~ 36 *Non-Defense: ~ 246*	• Diverse storage facilities include wet storage pool and numerous dry storage methods. • Sodium-bonded used fuel stored and may require treatment. • INL will continue to receive foreign research reactor (until 2019) and domestic research reactor used fuel. **_Batt_ Settlement Agreement** • **Used fuel into dry storage by Dec. 31, 2023.** • **Used fuel out of Idaho by Jan. 1, 2035.** • **Penalty for missed deadline is payment to State of $60,000/day (subject to appropriations) and potential suspension of used fuel receipts into Idaho.**
Fort St. Vrain, CO	15 *Defense: 0* *Non-Defense: 15*	• Used fuel in NRC-licensed dry storage facility. • Decommissioned commercial scale high-temperature gas-cooled reactor plant. **Agreement** • **Used fuel out of Colorado by Jan. 1, 2035.**
SRS, SC	~ 30 *Defense: ~ 19* *Non-Defense: ~10*	• Used fuels contained in wet storage. • Disposition alternatives for aluminum-clad used fuel under consideration. • Current plan to receive used fuel from foreign research reactors (until 2019) and domestic research reactors.
Other Sites	2 *Defense: <1* *Non-Defense: ~2*	• Oak Ridge National Laboratory, Brookhaven National Laboratory and the National Institute of Standards Testing.
Total	**~ 2,458** ***Defense: ~ 2,149*** ***Non-Defense: ~ 309***	

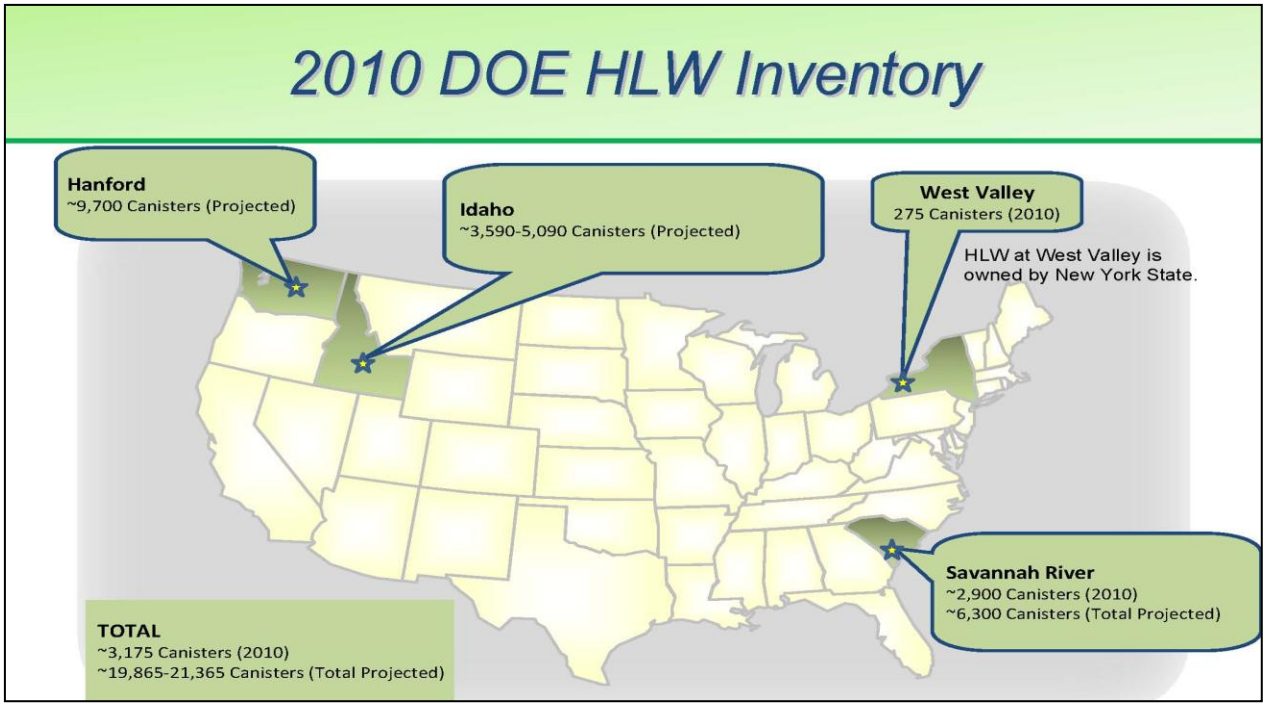
C. High-Level Waste Cleanup and Disposal Obligations from Federal Activities

DOE is responsible for the safe storage of 88 million gallons of tank waste, which consists of LAW and HLW, in 230 underground storage tanks at Hanford, SRS and INL. Tank waste, by far, is DOE's most significant environmental, safety and health threat, having significant regulatory, technical and policy issues. It is also the most expensive to process and clean up.[123]

According to DOE's current plan, HLW will be processed into stable long-lasting glass-type materials or other solid waste forms at various sites, where it will be stored until accepted at a geologic repository.[124] The classification of tank waste and the manner in which it is managed and disposed is defined in the NWPA.[125]

Due to ambiguity in the application of NWPA's definition of tank waste, DOE worked with Congress to provide better clarity. The result was Section 3116 of the Ronald W. Reagan

National Defense Authorization Act for Fiscal Year 2005.[126] Section 3116 allows DOE to close tanks on-site after removing highly-radioactive radionuclides to the maximum extent practicable. If this procedure is not followed, the tank contents may be considered HLW under the AEA and require treatment and geologic disposal. Section 3116 sets out requirements for the Secretary of Energy, in consultation with the NRC, to determine that the liquid remaining in the tanks after using best efforts to empty the tanks (known as "tank heels") does not require permanent



isolation in a deep geologic repository and may be disposed of in accordance with NRC objectives for low-level waste disposal.[127]

Figure 3. HLW Inventory.[128]

1. *Hanford Site High-Level Waste*

DOE estimates that there are over 50 million gallons of tank waste in 177 tanks at Hanford.[129] Under the current cleanup plan, this material will be removed from the tanks, separated into its LAW and HLW constituents, and then both constituents will be vitrified. The vitrified HLW will be placed into canisters for eventual removal to a geologic repository.[130] DOE is constructing the Waste Treatment and Immobilization Plant to perform these tasks. In addition to treatment of tank waste, treatment of the tanks at Hanford may be required.

Because Section 3116, described above, only applies to South Carolina and Idaho, but not Washington (*i.e.*, at SRS and INL but not at Hanford), DOE may consider the tanks themselves HLW for purposes of treatment, packaging and long-term storage. If the tanks are treated as HLW, DOE would be required to remove all equipment, piping and shells from the tanks, which would also have to be prepared and treated for disposal at the geologic repository. This would cause a major increase in the total volume of material requiring disposal at the Federal

repository. Currently, DOE plans to apply similar provisions through DOE Order 435.1 for disposing of tank heels, internal equipment, and the tank shells at Hanford.[131]

DOE has entered into a Federal Facility Agreement and Consent Order (known as the "Tri-Party Agreement") with EPA and Washington State, through the Washington Department of Ecology, for the cleanup of the Hanford site.[132] The Tri-Party Agreement sets forth dates by which all vitrification of HLW must be completed, but does not require that the vitrified waste be removed from Hanford by a date certain or specify requirements or restrictions on how the HLW will be removed from the State.[133] On October 26, 2010, the United States District Court for the Eastern District of Washington entered a consent decree that set new enforceable milestones for the completion of the Waste Treatment and Immobilization Plant, and set new interim deadlines for the retrieval of single-shell tank waste at Hanford. A separate settlement agreement linked to the consent decree deferred the deadline for treatment of all HLW at Hanford until 2047 and set a variety of milestones related to the final retrieval of single-shell tank waste, the closure of Hanford tank farms, and the remediation of groundwater contamination at the Hanford site.

In addition, the Hanford site contains over 2,200 capsules containing radioactive cesium and strontium. The draft EIS for management of Hanford tank wastes considers several options for treatment of this waste and defers a decision on ultimate removal of the material.[134]

2. *Savannah River Site High-Level Waste*

DOE estimates that there are 33.1 million gallons of tank waste in 49 tanks at SRS.[135] The Salt Waste Processing Facility ("SWPF") is being constructed at the site to treat and separate the tank waste into its two constituents – LAW and HLW. According to DOE's current plan, the SWPF will separate the LAW from the HLW, and solidify the LAW into a grout form for on-site disposal in large vaults.[136] The HLW will be sent to the Defense Waste Processing Facility to be vitrified. Canisters of vitrified waste will be stored on-site in special purpose facilities awaiting ultimate disposal in a deep geologic repository.[137]

DOE activities at SRS are governed by a Federal Facility Agreement, as well as a Site Treatment Plan and Consent Order pursuant to the FFCA.[138] The Site Treatment Plan requires DOE to maintain HLW canister production "sufficient to remove all waste from tanks by 2028,"[139] but, as with the Hanford Tri-Party Agreement, neither the Site Treatment Plan nor the FFCA requires the removal of HLW from the site by a specific date.

3. *Idaho National Laboratory High-Level Waste*

DOE estimates that there are 0.9 million gallons of sodium-bearing tank waste in 4 tanks at INL.[140] In addition, there are 4,400 cubic meters of calcine waste at INL.[141] According to the January 4, 2010, Amended Record of Decision ("ROD"), DOE will use hot isostatic pressing to treat the calcine to create a reduced-volume, monolithic waste that is suitable for transportation outside of Idaho. [142] The target date for completion of this calcine treatment is December 31, 2035.[143] The treated calcine waste may then be moved to either a RCRA-permitted or non-RCRA permitted facility.[144] DOE will treat the sodium-bearing tank waste in the Integrated Waste Treatment Unit ("IWTU") that is currently under construction. DOE's preferred disposal

path for the sodium-bearing tank waste is disposal as TRU at WIPP. Until regulatory approvals are obtained and a determination that sodium-bearing waste is TRU is made, DOE will manage the waste to allow disposal at WIPP or at a geological repository for used fuel and HLW. [145]

According to the *Batt* Settlement Agreement described above, DOE will treat all HLW and sodium- bearing waste at INL, in preparation for final disposal elsewhere, by a target date of 2035.[146]

4. *West Valley Demonstration Project High-Level Waste*

West Valley, New York is the only commercial nuclear fuel reprocessing plant to have operated in the United States.[147] After beginning operations in 1966, the facility processed a total of 640 tons of waste in six years before shutting down in 1972. Major changes in regulatory requirements for such plants between 1972 and 1976 prevented it from reopening.[148] In that time, it accumulated over 600,000 gallons of high-level waste in onsite storage tanks.[149]

The West Valley Demonstration Project became a unit of the DOE in 1980 as a result of the West Valley Demonstration Project Act of 1980.[150] The Act made DOE responsible for solidifying the HLW and decommissioning the facilities used in the process. Contingent upon the State of New York entering into a Standard Contract for disposal of the solidified HLW with DOE and paying the associated fees, DOE is also responsible for disposing of the solidified waste. In fulfillment of these responsibilities, DOE constructed a vitrification plant at the site and converted all of the tank waste into 275 canisters of glass-type materials. DOE is storing the canisters of vitrified HLW on site until a geologic repository is available.[151]

Table 6. Key DOE Obligations Related to HLW.[152]

Site	Canisters	Tank Waste (gal.)	Tanks	Agreement
Hanford, WA	0 existing ~ 9,700 projected	53 million	177	• **"Tri-Party Agreement" between DOE, EPA and Washington State.** • Sets forth dates for vitrification of HLW. • Requires retrieval of all single-shell tanks by 2040 and completing treatment of tank waste by 2047 (pending DOE change request). • Removal of HLW from site by date certain not established.
Savannah River, SC	~ 2,900 existing ~6,300 projected	33.1 million	49	• Construction of Salt Waste Processing Facility at site to treat and separate the tank waste. • Federal Facility Agreement, Site Treatment Plan, and Consent Order in place. ➢ Requires DOE to maintain canister production sufficient to remove all waste from tanks by 2028. ➢ No date certain set to require the removal of HLW from the site.
Idaho National Lab, ID	0 existing ~ 3,590 -	0.9 million	4	• ***Batt* Settlement Agreement signed Oct. 1995.** • DOE must take specified steps for treatment and storage of HLW.

	5,090 projected			• DOE will treat remaining sodium bearing wastes in the Integrated Waste Treatment Facility, which is currently under construction.
West Valley Demonstration Project, NY	275	600,000 gallons	Tank waste converted into 275 glass canisters	• West Valley Demonstration Project Act of 1980 makes DOE responsible for solidifying the HLW, disposing of waste created by the solidification (contingent upon the State of NY entering into and paying fees pursuant to a Standard Contract for HLW disposal with DOE), and decommissioning the facilities used in the process. • Vitrification plant was constructed and converted all of the tank waste into 275 canisters of glass-type materials. • Canisters of vitrified HLW on West Valley site until a geologic repository is available.
TOTAL	**~ 3,175 existing** **~19,865 – 21,365 projected**	**90 million gal. tank waste** **8,000-17,000 MTHM total HLW**		

D. Special Nuclear Material Obligations

While it is beyond the scope of this paper, it should be noted that in addition to DOE's obligations related to HLW and used fuel, some special nuclear materials – particularly those amounts of highly enriched uranium that are contained in used fuel assemblies – may ultimately be stored in a geologic repository. In many cases, DOE has not yet issued the record of decision governing the processing and ultimate disposition of these materials. These materials include plutonium – currently being consolidated at SRS from Hanford, Lawrence Livermore National Laboratory ("LLNL"), and Los Alamos National Laboratory ("LANL"); highly enriched uranium – currently stored at SRS, INL, Oak Ridge National Laboratory, LLNL, LANL, Sandia National Laboratory and the Knolls Atomic Power Laboratory; and depleted uranium hexafluoride – currently located at the Portsmouth Gaseous Diffusion Plant, Paducah Gaseous Diffusion Plant, and Oak Ridge National Laboratory. Depending on DOE's final decisions for treating these materials, some or all of these materials may require permanent storage in the geologic repository.[153]

III. FOREIGN AND DOMESTIC RESEARCH REACTORS

Research reactors are small nuclear reactors used primarily to conduct research, to develop theoretical practices, and for education or medical purposes.[154] Their output is typically a fraction of a percent of the output of a commercial electric utility reactor. According to a 2006 study by the National Academy of Sciences, DOE is responsible for managing used fuel from three categories of research reactors:

- Research reactors located at DOE facilities, including Oak Ridge National Laboratory in Tennessee (the High Flux Isotope Reactor); Idaho National Laboratory (the Advanced Test Reactor); Sandia National Laboratories (the Annular Core Research Reactor and Pulsed Reactor Facility); and Argonne National Laboratory (the Neutron Radiography Reactor).
- Foreign research reactors: Located in 41 countries, these reactors use fuel manufactured in the United States from fissionable material provided by the U.S. Government under the Atoms for Peace Program.
- Research reactors operated by U.S. universities, U.S. Government agencies other than DOE, and private-sector firms: As of November 2009, the NRC reported there were 32 operating research reactors and 9 in the process of decommissioning.[155] All such reactors are required to be licensed by the NRC.

A. Foreign Research Reactors

As a part of the "Atoms for Peace" program, in the 1950's, the United States began entering into bilateral agreements with other nations to promote the peaceful use of nuclear technology. Under these agreements, the United States provided nuclear technology for non-weapon applications in exchange for a commitment by the other nation not to develop nuclear weapons. As a part of this program, the United States supplied these nations with the HEU then required to fuel research reactors. Until 1964, the HEU was leased to the other nations under an explicit agreement that used nuclear fuel be returned to the United States. After 1964, most agreements involved the sale of HEU to the other nation. That year also marked the beginning of the United States Government's "Off-Site Fuels Policy," under which it continued to accept used fuel for temporary storage and separation.[156]

In 1978, the United States created the RERTR Program to reduce the danger of proliferation by converting research reactors from HEU to LEU. Under RERTR, a number of foreign research reactors agreed to convert their reactors to run on LEU fuel, but made conversion contingent upon the continued willingness of the United States to accept used fuel. However, under the Off-Site Fuels Policy, United States acceptance of spent LEU and HEU fuels ended in 1992 and 1988, respectively.[157]

In 1993, DOE prepared an EIS to assess the impacts of extending the program to accept up to 15,000 additional used fuel elements from foreign reactors containing enriched uranium that had originated in the United States. During preparation of the EIS, DOE adopted the "Urgent-Relief Acceptance of Foreign Research Reactor Spent Nuclear Fuel" policy under which it accepted limited shipments of up to 409 used fuel elements from eight research reactor operations in Europe that were running out of storage capacity. The policy was deemed necessary in order to prevent those reactors from shutting down or reprocessing fuel abroad, where the reprocessed HEU would enter commerce, undermining U.S. nonproliferation policy.[158]

The same rationales supported DOE's decision in 1996 to extend acceptance of used fuel through RERTR under the Nuclear Weapons Nonproliferation Policy.[159] In addition to the need to prevent foreign reactors from shutting down or from reprocessing HEU fuel abroad, DOE noted

that no foreign reprocessing facilities were capable of reprocessing the high-density LEU fuel developed under the RERTR program. DOE was concerned that if the United States refused to accept the LEU fuel for reprocessing or storage, foreign research reactors would continue using or revert back to using HEU fuel, increasing the quantity of HEU in commerce and, thus, the risk that some amount of HEU would be diverted into a weapons program.

DOE decided to reinstate the acceptance policy for ten years, with the understanding that this would allow foreign reactors sufficient time to convert to LEU fuel and for the foreign reactors and their host countries to make arrangements for disposition of the used LEU fuel. Under the extended policy, DOE decided to accept and store used fuel initially enriched in the United States that was either then in storage or anticipated to be generated and discharged at 107 then-operational reactors in 41 countries during the ten years the policy would remain in effect (through May 13, 2006).[160] The accepted material was projected to be equivalent to 19.2 MTHM of used fuel (contained in up to 22,700 individual fuel elements) and up to an additional 0.6 MTHM of target material. Reactors then using HEU fuel that desired to ship material to the United States were required under the policy to commit to convert to LEU fuel.[161] To allow discharged material to decay sufficiently to be transported, the policy provided for the United States to accept used fuel for up to 13 years after the policy came into effect (through May 12, 2009). Under the policy, DOE took title to the fuel and target material that was shipped by sea after it is unloaded from the ship at the port of entry or at the border crossing for material shipped overland.[162] High-income countries were charged a competitive fee, while the United States absorbed the cost of acceptance of the fuel from other countries.[163]

In 2004, DOE issued a revised Record of Decision ("ROD") extending the acceptance policy for another ten years. Under the extension, the United States will accept eligible fuel through May 12, 2019, provided it was irradiated by May 12, 2016. The extension was justified on the grounds that, as of 2004, the United States had received only approximately 35% of the material estimated to be eligible for return under the EIS underlying the initial ROD. DOE attributed the low yield to slower than expected fuel usage, alternative arrangements for used fuel processing from some reactors, and technical delays in the development of the LEU fuels needed to allow reactors using HEU fuels to convert.[164]

With one exception, the extended policy applies only to reactors operational in May 1996, when the original ROD was issued. The High Flux Australian Reactor was eligible to participate in the acceptance program, and was scheduled for decommissioning in 2006 to be replaced by the Research Replacement Reactor. The replacement reactor was to use a new type of LEU fuel that could be processed by non-U.S. facilities. Because of delays in developing the new LEU fuel, however, DOE anticipated that the replacement reactor would be required to use an existing type of LEU fuel through 2012 that would require management in the United States. Acceptance of this used fuel was projected to add 96 elements to the waste quantity estimates in the original EIS.[165]

DOE issued a further modification of the ROD in 2009. This revision expanded the acceptance policy to incorporate "Gap Material Spent Nuclear Fuel." The Gap Material was projected to consist of up to 1 MTHM of used HEU fuel that is of non-U.S. origin or not covered under the prior acceptance policy and that meets the following criteria:

- Poses a threat to national security;
- Is susceptible for use in an improved nuclear device;
- Presents a high risk of terrorist threat; and
- Lacks access to another reasonable pathway to assure security from theft or diversion.

Under the modified ROD, gap material is to be stored at SRS pending disposition. DOE determined that the acceptance of this material would not alter the total amount of used fuel addressed in the initial EIS.[166] Therefore, under the Nuclear Weapons Nonproliferation Policy and the decision to accept gap material, the United States still anticipates accepting a total of 19.2 MTHM of used fuel (contained in up to 22,700 individual fuel elements) and up to an additional 0.6 MTHM of target material. As of March 2010, 9,200 assemblies from 29 countries have been received. Most foreign reactor fuel is stored at INL, and is required to be removed from that site by 2035.[167]

B. Domestic Research Reactors

According to statistics maintained by the International Atomic Energy Agency, there are 227 nuclear research reactors located in the United States, of which 41 are operational and 186 have been shut down or decommissioned (one of the 41 reactors listed as "operational," located at Worcester Polytechnic Institute, appears to have been shut down).[168] Eleven of the reactors IAEA lists as "operational" are owned by the Federal Government. In addition, DOE reports that there are 27 currently operating research reactors at 26 U.S. educational institutions.[169] Under the Research Reactor Infrastructure program, DOE accepts used fuel from university research reactors. Van Ness Feldman was unable to determine based on publicly available documents the quantity of waste from domestic research reactors that DOE is responsible for managing and storing.

IV. FEDERAL TRANSPORTATION COMMITMENTS

A. Background

DOE operates a complicated transportation program for used fuel and HLW. The program is highly decentralized and involves a large number of parties in both government and the private sector over which DOE has limited control.[170] The transportation program is governed by both federal and state regulations, as well as numerous transportation commitments memorialized in Standard Contracts,[171] transportation protocols, and transportation plans.[172] Specific information about the number of shipments, possible routes, time frame, quantity, and type of material being shipped is not readily available due to its sensitive nature.[173]

B. The Legal Regime

1. *Federal Transportation Regulations*

DOE transports used fuel and HLW under a number of Federal, state, and local statutes and regulations. The principal Federal agencies, other than DOE, that are responsible for regulating the transportation of used fuel and HLW are DOT and the NRC.

- DOT is responsible for regulating the safety of radioactive material shipments under several statutes, including the Department of Transportation Act and the Hazardous Materials Transportation Act.[174]
- The NRC is responsible for licensing and regulating the transfer of special nuclear materials under the AEA and the Energy Reorganization Act.

The responsibilities of DOT and the NRC for regulating the transportation of radioactive materials are defined by an MOU between the two agencies.[175] In accordance with the MOU, NRC has authority, in consultation with DOT, "for developing standards and regulations for the design, performance, and inspection of transportation packages for" used fuel and HLW.[176] The MOU recognizes the NRC's responsibility for implementing DOT regulations and conducting inspection activities for shipments of used fuel by its licensees. In addition, DOT routing regulations[177] recognize the NRC's responsibility for providing physical protection requirements for used fuel shipments. DOE also voluntarily complies with DOT inspection requirements.[178] The MOU recognizes DOT as having the primary responsibility, in consultation with NRC, for issuing safety requirements for the transportation of radioactive materials.[179] DOT also has primary responsibility for inspecting transportation activities by carriers for both NRC licensee and non-NRC licensee activities, such as shipments by DOE.[180] DOE has authority under DOT regulations,[181] unless otherwise specified in law, to certify packages for the domestic transportation of its own used fuel and HLW.[182]

2. *State Transportation Regulations*

States and local governments play important roles in used fuel and HLW transportation. States have a responsibility to enforce DOT highway safety regulations concerning Federal motor carrier safety and hazardous materials transportation.[183] All 50 States and the District of Columbia retain authority for carrier safety and emergency response.[184]

3. *Transportation Protocols and Plans*

Although the web of transportation regulations is complicated, small-quantity used fuel shipping programs have been carried out routinely by both DOE and the private sector for several decades. The primary objective of these programs has been to move used fuel to storage.[185]

DOE's TM standardized the process and framework of DOE's radioactive material shipments by establishing 14 transportation practices. The TM covers highway and rail shipments of used fuel and HLW, and classified national security shipments, such as Naval used fuel rail shipments.

DOE Headquarters organizations oversee the transportation activities for their respective Offices. The Headquarters organizations responsible for shipping include the EM, NE, Science, OCRWM, and NNSA.[186] For transportation of wastes that do not implicate national security, DOE uses commercial carriers that transport materials under the same terms and conditions as commercial shipments.[187]

The TM outlines DOE's plans to continue to coordinate with States and Tribes planning for used fuel and HLW shipments, including specific routes.[188] Once DOT, DOE and the NRC identify preferred shipping routes in consultation with States, each State Governor is notified in advance of used fuel shipments.[189] Federal officials track the shipments using a satellite-based tracking system, but specific timing and routes of shipments are kept safeguarded for security reasons.[190]

How does Yucca Mountain Uncertainty Affect Transportation?
Regardless of whether Yucca Mountain becomes the site of a permanent repository, transportation of radioactive materials will continue.[191] Used fuel and HLW is currently temporarily stored at 131 sites in 39 States.[192] Nuclear materials at DOE's environmental cleanup sites, in particular, must move to one or more other locations in order for cleanup to progress toward completion.[193] And commercial facilities, which will continue to produce used nuclear fuel, eventually must also transport their used fuel to permanent storage.[194]

If the Yucca Mountain Project does become operational, the total shipping campaign would include 1,100 truck shipments and 3,500 train shipments under the "mostly rail" option defined in DOE's final EIS for the Project.[195] To implement this option, DOE would need to construct a 319-mile rail spur in Nevada and may have to make other infrastructure improvements to provide rail access at commercial nuclear sites.[196]

C. Mode of Transportation

DOE ships used fuel and HLW via rail and road. Rail shipments of used fuel and HLW are subject to inspection by DOT's Federal Railroad Administration.[197] DOE has current transportation commitments with railroads to transport used fuel and HLW. In 1981, DOE and the U.S. Department of Defense ("DOD") filed complaints at the Interstate Commerce Commission ("ICC") against 21 major railroads for charging excessive rates for such transportation, but subsequently entered into a settlement agreement with Union Pacific Railroad Company, the then-presumed destination carrier for most of the used fuel movements that are to be covered by the agreement.[198] The settlement agreement covers (1) single-line rates charged only by Union Pacific for such shipments, and (2) ground rules for challenges to so-called "through rates" (*i.e.*, those involving two or more railroads).[199] Litigation against the remaining defendants is ongoing before the Surface Transportation Board ("STB"), the Federal agency with exclusive jurisdiction over transportation of freight by railroad (and the statutory successor to the ICC). DOE and DOD report every three months to the STB on their settlement discussions with some of the remaining Defendants.

Highway truck shipments of used fuel and HLW are subject to DOT highway regulations, which are enforced by the States through which the shipments move. Small-quantity used fuel truck shipments have been carried out routinely for several decades, and DOE's TM provides some

guidance for highway routing. DOE analyzes proposed routes using transportation models and selects shipping routes in accordance with DOE regulations.[200] States and Tribes may also select highway routes in accordance with DOE regulations, which are then documented in specific transportation plans.[201] Some shipments, such as university and research reactor used fuel shipments, are subject to NRC licenses. In such cases, the shipper or transportation contractor submits highway routes to the NRC for approval.[202]

D. Sources of DOE-Transported Waste

DOE transports used fuel and HLW from commercial sites, foreign and domestic research reactors, and Naval propulsion sources.[203] Over the last 30 years, there have been over 2,700 shipments of used fuel.[204] According to its 2009 Transportation Plan, DOE anticipates shipping to a repository 63,000 MTHM from commercial used fuel, 2,333 MTHM of DOE used fuel and NNPP used fuel, and 4,667 MTHM of DOE HLW.[205]

1. *Commercial Sources*

The first irradiated fuel shipments were made by the Manhattan Project as part of the national effort to develop atomic weapons. By the early 1960s, civilian used fuel was being transported on road and rail by the AEC.[206] In 1974, the AEC was reorganized, and authority for regulating the commercial transport of radioactive materials transportation was given to the newly established NRC.[207] Most used fuel transportation across the nation's public highways and private railroads has involved small-quantity shipments of commercial used fuel. From 1998-2004, there were 102 used fuel highway shipments and 261 used fuel rail shipments.[208] The NRC's Office of Nuclear Material Safety and Safeguards ("NMSS") regulates the transportation of used fuel and HLW. In FY 2009, NMSS issued 93 transportation certificates of compliance, and, by the end of May 2010, NMSS had completed an additional 38 transportation certificates of compliance.[209]

DOE's OCRWM has spent $780 million to transport used fuel and HLW since 1983, and estimates that total costs will equal $20.25 billion by 2133.[210] DOE is obligated to transport used fuel and HLW under agreements with NRC licensees for movement of commercial used fuel under the DOE Standard Contract.

In its FY 2011 budget, the Obama Administration requested that the U.S. Congress eliminate funding for OCRWM. While the Administration's budget request is subject to Congressional action, it appears likely that OCRWM's role going forward in the transportation of commercial wastes is likely to be significantly curtailed, if not eliminated entirely. According to DOE's website, DOE's Office of Nuclear Energy will assume responsibility for all activities currently performed by OCRWM.[211]

Pending the outcome of the Administration's request to terminate the office, OCRWM retains responsibility for transporting the used fuel and HLW of NRC licensees under the DOE Standard Contract. The 2009 National Transportation Plan contains OCRWM's plan for fulfilling those responsibilities. The plan describes the elements of the national transportation system that OCRWM is developing, the phases of that development effort, and how OCRWM will

collaborate with stakeholders in the development and implementation of that system.[212] As the system matures, OCRWM anticipates that the more detailed planning documents for the national transportation system will include a national operations plan, campaign plans, fleet maintenance and inventory management plans, security plans, and emergency response plans.[213]

Under the 2009 National Transportation Plan, OCRWM collaborates with State Regional Groups ("SRGs") that are authorized to sign cooperative agreements on behalf of their member states. The SRGs include: Council of State Governments' Northeast High-Level Radioactive Waste Transportation Task Force, Council of State Governments' Midwestern Radioactive Materials Transportation Committee, Southern States Energy Board's Radioactive Materials Transportation Committee, and Western Interstate Energy Board's High-Level Waste Committee.[214]

DOE divides the development of the OCRWM transportation system into two capital projects: the National Transportation Project and the Nevada Rail Infrastructure Project (also known as the Nevada Rail Line Project).[215] The National Transportation Project is responsible for acquiring rail and truck cask systems, designing and testing rolling stock, and developing facilities to maintain and store casks and rolling stock. The Nevada Rail Infrastructure Project encompasses the design, acquisition of materials and equipment, construction, testing, and certification of a Nevada rail line for the transportation of used fuel and HLW to the Yucca Mountain repository. The future of this Project is uncertain, of course, because of DOE's intended termination of the Yucca Mountain Project.

The cost and the schedule for OCRWM projects, as well as the development of the transportation system, depend on funding availability and the necessary appropriations. As a result, OCRWM is developing a Transportation System Operations Plan to identify operational requirements based on an analysis of the transportation system and regulatory requirements that must be met.[216] A Transportation Program Management Plan will also be developed to identify transportation programmatic requirements and define how they will be implemented.[217]

2. *Foreign and Domestic Research Reactors*

SRS and INL are the primary destinations for used fuel from foreign and domestic research reactors. Since 1996, the two sites have received between 20 and 60 packages each year containing research reactor spent fuel.[218] Domestic research reactor spent fuel is transported by truck.[219] Foreign research reactor used fuel from overseas arrives at the Charleston Naval Weapons Station in South Carolina and is then transported by truck to SRS.[220] Some of these shipments continue onward to the INL using one of three highway routes established by DOE in consultation with States and Tribes.[221] DOE has shipped 40 metric tons of used fuel from 41 countries, with 30 shipments completed as of November 2004.[222]

DOE, other Federal civilian agencies, and U.S. universities have regularly shipped used fuel from research reactors to DOE facilities. DOE, employing commercial carriers, is directly responsible for the transportation of used fuel from its own research reactors and for transportation from SRS to INL.[223] DOE oversees all aspects of the planning and conduct of shipments from Charleston Naval Weapons Station to SRS.[224]

DOE plays no role in route selection for shipments of used fuel from U.S. university and other domestic research reactors, including the selection of routes to comply with DOT regulations and submission of routes to the NRC for approval.[225] Instead, these issues are the responsibility of reactor licensees and their commercial carriers.

3. *Naval Nuclear Propulsion Program*

Since 1957, the used fuel removed from nuclear-powered naval vessels and prototypes has been transported from shipyards and prototype sites to the Naval Reactors Facility at INL.[226] All NNPP used fuel is transported to INL via rail. The carrier used depends on the source of the used fuel. Carriers that transport to INL include Union Pacific,[227] the Burlington Northern Santa Fe Railway,[228] CSX Transportation, and Norfolk Southern Railway.[229]

E. Transuranic Radioactive Waste: Transportation to the Waste Isolation Pilot Plant

EM also manages transportation of TRU to the WIPP.[230] DOE will continue to generate transuranic waste through at least 2050 from ongoing missions as well as from the deactivation and decommissioning of radioactive waste treatment facilities.[231]

The WIPP is subject to various memoranda of agreement, cooperative agreements, protocols, and transportation plans, and has had 37,723 planned transuranic shipments as of 2002, with 435 completed by November of 2001.[232] Between 2002 and 2007, the TRU waste program at the WIPP accelerated shipments from generator sites to a maximum of over 30 per week.[233] Overall, an additional 6,600 shipments of TRU waste went to the WIPP between 2002 and 2009.[234] DOE also created a Waste Management Programmatic Environmental Impact Statement examining the environmental impacts associated with moving TRU to treatment, storage, and disposal sites and the transportation impacts associated with moving HLW to storage sites.[235] However, this document is not publicly available.

CONCLUSION

Beginning with the Manhattan Project, the Federal Government has made a large number of commitments, and incurred many obligations (by statute, judicial orders, consent decrees, agreements, or contracts), with respect to nuclear materials, including used commercial fuel, defense-related used fuel, foreign used fuel, and HLW. Given the nature of these materials, it is inescapable that the Federal Government will continue to have numerous, substantial obligations far into the future for such materials. To the extent feasible, those commitments and obligations are set out in detail in this Memorandum. However, there are likely additional commitments or obligations that are classified.

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[1] John Kessler, Electric Power Research Inst., Presentation to Blue Ribbon Commission on America's Nuclear Future, Subcomm. on Transportation and Storage (Aug. 19, 2010), *available at* http://brc.gov/Transportation_Storage_SC/docs/TS_SC_08-19_mtg/2_EPRI_Used_Fuel_Inventory-August_2010_final_John%20Kessler.pdf. EPRI projected that, assuming no new nuclear expansion, commercial used fuel inventories could reach 96,000 MTHM in 2025 and 133,000 MTHM in 2050.

[2] Frank Marcinowski, Office of Envtl. Mgmt., U.S. Dep't of Energy, Overview of DOE's Spent Nuclear Fuel and High-Level Waste (March 25, 2010) ("Used Fuel and HLW Overview"), *available at* http://brc.gov/pdfFiles/Environmental_Management_BRC_03252010.pdf.

[3] U.S. Dep't of Energy, Status of Environmental Management Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War at 24 (Jan. 2009) ("Status Report 2009"); *see also* U.S. Dep't of Energy, The Report to the President and the Congress by the Secretary of Energy on the Need for a Second Repository 5 (2008) ("Second Repository Report"), *available at* http://www.energy.gov/media/Second_Repository_Rpt_120908.pdf (last visited Aug. 24, 2010) (providing an estimate of 10,300 MTHM).

[4] Nuclear Waste Policy Act of 1982, Pub. Law No. 97-425, 96 Stat. 2201, (1982) (codified as amended at 42 U.S.C. § 10101 *et seq.* (2006)).

[5] Budgetary Implications of Closing Yucca Mountain: Hearing Before the H. Comm. on the Budget, 111th Cong. 5 (2010) (statement of Kim Cawley, Chief, Natural Res. and Physical Res. Cost Estimates Unit, U.S. Cong. Budget Office ("CBO Testimony").

[6] Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub. L. No. 96-150, 94 Stat. 2767 (1980) (codified as amended at 42 U.S.C. § 9601 *et seq.*).

[7] *See also* Executive Order 12580, Jan. 23, 1987, 52 Fed. Reg. 2923.

[8] National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat. 852 (1970) (codified as amended at 42 U.S.C. § 4321 *et seq*. (2006)).

[9] Federal Facility Compliance Act of 1992, Pub. L. No. 102-386, 106 Stat. 1505 (1992) (codified at 42 U.S.C. § 6901 (2006)).

[10] *See* Table 2, *infra* n.12 and 120 and pp. 22-24.

[11] *See id*. and Table 3, *infra* n.15 and 147 and Parts II and III.

[12] Used Fuel and HLW Overview, *supra* n.2; *United States v. Batt*, Settlement Agreement at Sec. D (1995), *available at* https://idahocleanupproject.com/Portals/0/documents/1995SettlementAgreement.pdf ("*Batt* Settlement Agreement"); U.S. Dep't of Energy, Kathleen Hain, Idaho Cleanup Project, Idaho Site Spent Nuclear Fuel Management 4 (June 2010) ("Idaho Spent Fuel Management"), *available at* http://www.nwtrb.gov/meetings/2010/june/hain.pdf.

[13] Estimated life-cycle cost of tank waste cleanup is between $87 billion and $117 billion. *See* U.S. Dep't of Energy, Status of Environmental Management Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War at 24 (Jan. 2009) ("Status Report 2009").

[14] Record of Decision for the Dep't of Energy's Waste Management Program: Storage of High-Level Radioactive Waste, 64 Fed. Reg. 46,661 (Aug. 12, 1999).

[15] Used Fuel and HLW Overview, *supra* n.2; *Batt* Settlement Agreement, *supra* n.12; Idaho Spent Fuel Management, *supra* n.12.

[16] Record of Decision for the Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, Part IV, 61 Fed. Reg. 25,092 (May 13, 1996) .

[17] *See* Part IV.C.2, *infra*, for a description of transportation requirements for this used fuel.

[18] DOE interprets the relevant statutory texts as granting the agency sole authority over the transportation of used fuel and HLW. *See* U.S. Dept. of Energy, Office of the Assistant General Counsel for Civilian Nuclear Programs, "Comments on August 31, 2010 (Revised November 12, 2010), Report on 'Federal Commitments Regarding Used Fuel and High-Level Wastes' " at 4, *available at* http://www.brc.gov/e-mails/March%2011/Comments_on_Van_Ness_Feldman_Paper_to_BRC_1-24-11.pdf. As used here, the term "transportation" refers broadly to all acts associated with transporting used fuel and HLW from one site to another, a definition that encompasses regulations addressing such related actions as NRC certifications of used fuel and HLW packages and to notification of state and local governments.

[19] Department of Transportation Act of 1966, Pub. L. No. 89-670, 80 Stat. 931 (1966) (codified at 49 U.S.C. § 1655).

[20] Hazardous Materials Transportation Act of 1975, P.L. 93-633 (1975) (codified as amended at 49 U.S.C. §§ 1801–1812 (2006)).

[21] *Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-level Radioactive Waste in the United States*, Nat'l Research Council Comm. on the Transp. of Radioactive Waste at fn 29 (2006), *available at* http://books.nap.edu/catalog.php?record_id=11538 ("National Research Council Study").

[22] U.S. Dep't of Energy, Office of Civilian Radioactive Waste Management, DOE/RW-0603, National Transportation Plan 1 (Jan. 2009), *available at* http://www.csgmidwest.org/About/MRMTP/ShipmentPlanning/NTP_Rev0_January2009.pdf ("2009 National Transportation Plan").
[23] *See, e.g.*, Atomic Energy Act of 1954 § 2(h), 60 Stat. 755 (1954) (codified as amended at 42 U.S.C. § 2011 *et seq*. (2006)) ("It is essential to the common defense and security that title to all special nuclear material be in the United States while such special nuclear material is within the United States"); § 52 ("Government Ownership Of All Special Nuclear Material.–All rights, title, and interest in or to any special nuclear material within or under the jurisdiction of the United States, now or hereafter produced, shall be the property of the United States and shall be administered and controlled by the Commission as agent of and on behalf of the United States by virtue of this Act.").
[24] Private Ownership of Special Nuclear Materials Act, Pub. L. 88–489, 78 Stat. 602 (1964) (codified at 42 U.S.C. § 2011 (2006)).
[25] Nuclear Waste Policy Amendments Act of 1987, Pub. L. No. 100-202, Sec. 101(d) [title III [H.R. 3545, title V, subtitle A]], 101 Stat. 1329 (1987), Pub. L. No. 100-203, title V, subtitle A, 101 Stat. 1330 (1987) (codified at 42 U.S.C. § 10101 (2006)).
[26] NWPA § 121(a). Note that Section 801 of the Energy Policy Act of 1992 superseded NWPA § 121(a) and requires EPA to use its existing authority to promulgate site-specific standards for "releases from radioactive materials stored or disposed of in the repository at the Yucca Mountain site." 106 Stat. 291, 42 U.S.C. § 10141.
[27] NWPA § 112.
[28] NWPA § 137; Transp. of Radioactive Materials; Memorandum of Understanding, 44 Fed. Reg. 38,690 (July 2, 1979); *see Consol. Rail Corp. v. Interstate Commerce Comm'n*, 646 F.2d 642 (D.C. Cir.1981), cert. denied, 454 U.S. 1047 (1981).
[29] NWPA § 302(b)(1)(A).
[30] Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste, 10 C.F.R. § 961.11 (2010).
[31] NWPA § 302(b).
[32] 10 C.F.R. § 961.11, Arts. IV.B.1, VIII.A.1.
[33] *Id*. at Art. VII.
[34] *Id*. at Art. II; *see* NWPA § 302(a)(5)(B).
[35] 10 C.F.R. § 961.11, Art. VI.B.1(a). The Standard Contract provides exceptions from the "acceptance priority ranking" for emergency deliveries and instances where the generator misclassifies the used fuel or HLW.
[36] *Id*.
[37] U.S. Dep't of Energy, Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites 5 (Dec. 2008), *available at* http://www.energy.gov/media/ES_Interim_Storage_Report_120108.pdf (last visited Aug. 20, 2010).
[38] *Id*.
[39] *Id*.
[40] 10 C.F.R. § 961.11, Art. II.
[41] Budget Implications of Closing Yucca Mountain: Hearing Before the H. Comm. on the Budget, 111th Cong. 2 (2010) (statement of Kristina M. Johnson, Under Secretary of Energy, U.S. Dep't of Energy).
[42] CBO Testimony at 2.
[43] *Id*.
[44] *Id*. at 2-3.
[45] DOE has taken title to some commercial power reactors. However, the agency has done so only for special case reactors – such as the Three Mile Island Unit No. 2 reactor – used to support DOE-sponsored research and development programs. *See* U.S. Dep't of Energy, EIS-0203F, DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, *available at* http://nepa.energy.gov/finalEIS-0203.htm ("PEIS").
[46] NWPA § 6.
[47] Jay M. Gutierrez & Alex S. Polonsky, Fundamentals of Nuclear Regulation in the U.S. 217-19 (2nd ed. 2007).
[48] *Nuclear Energy Inst., Inc. v. EPA*, 373 F.3d 1251, 1257 (D.C. Cir. 2004).
[49] H.R. Rep. No. 107-425, at 3 (2002), *reprinted in* 2002 U.S.C.C.A.N. 532, 532-33.

[50] In the Matter of U.S. Dep't of Energy (High-Level Waste Repository); Notice of Hearing and Opportunity to Petition for Leave to Intervene on an Application for Authority to Construct a Geologic Repository at a Geologic Repository Operations Area at Yucca Mountain, 73 Fed. Reg. 63,029 (Oct. 22, 2008).
[51] Motion to Withdraw of the U.S. Dep't of Energy, *U.S. Dep't of Energy (High-Level Waste Repository)*, NRC Docket No. 63-001-HLW & ASLBP No. 09-892-HLW-CAB04 (filed March 3, 2010).
[52] Order, *U.S. Dep't of Energy (High-Level Waste Repository)*, NRC Docket No. 63-001-HLW (issued June 30, 2010).
[53] Motion for Recusal or Disqualification of the State of Wash., State of S.C., Aiken County, S.C., and White Pine County, Nev., *U.S. Dep't of Energy (High-Level Waste Repository)*, NRC Docket No. 63-001-HLW (filed July 9, 2010).
[54] Notice of Recusal, *U.S. Dep't of Energy (High-Level Waste Repository)*, NRC Docket No. 63-001-HLW (issued July 15, 2010).
[55] Decision on the Motion for Recusal or Disqualification of the State of Wash., State of S.C., Aiken County, S.C., and White Pine County, Nev., *U.S. Dep't of Energy (High-Level Waste Repository)*, NRC Docket No. 63-001-HLW (issued Aug. 11, 2010); Decision on the Motion for Recusal or Disqualification of the State of Wash., State of S.C., Aiken County, S.C., and White Pine County, Nev., NRC Docket No. 63-001-HLW (issued Aug. 11, 2010).
[56] Petition for Declaratory and Injunctive Relief and Writ of Mandamus, *In re: Aiken County*, No. 10-1050 (D.C. Cir. Feb. 19, 2010).
[57] Petition for Review, *Robert Ferguson, et al. v. DOE, et al.*, No. 10-1052 (D.C. Cir. Feb. 25, 2010); Petition for Review and Petition for Writ of Mandamus, Write of Prohibition, Stay and/or Declaratory and Injunctive Relief of the State of S.C., *State of S.C. v. U.S. Dep't of Energy, et al.*, No. 10-1069 (D.C. Cir. Feb. 26, 2010); Petition for Review and for Declaratory and Injunctive Relief of the State of Wash., *State of Wash. v. U.S. Dep't of Energy, et al.*, No. 10-1082 (D.C. Cir. Apr. 12, 2010).
[58] Order vacating briefing schedule and holding in abeyance, *In re: Aiken County*, No. 10-1050 (D.C. Cir. July 28, 2010).
[59] All lawsuits filed against DOE based on the Standard Contract have also included Constitutional takings in addition to the claims on the Contract. However, these claims have uniformly been dismissed. U.S. Cong. Research Service, Report for Congress, The Yucca Mountain Litigation: Breach of Contract Under the Nuclear Waste Policy Act of 1982 6 (2009), *available at* http://ncseonline.org/NLE/CRSreports/10Jan/R40996.pdf (last visited Aug. 23, 2010).
[60] *Ind. Mich. Power Co. v. U.S. Dep't of Energy*, 88 F.3d 1272 (D.C. Cir. 1996).
[61] *Id.* at 1274.
[62] *N. States Power Co. v. U.S. Dep't of Energy*, 128 F.3d 754 (D.C. Cir. 1997).
[63] *Neb. Pub. Power Dist. v. United States*, 590 F.3d 1357 (Fed. Cir. 2010).
[64] *Me. Yankee Atomic Power Co. v. United States*, 225 F.3d 1336 (Fed. Cir. 2000).
[65] *Ind. Mich. Power Co. v. United States*, 422 F.3d 1369 (Fed. Cir. 2005).
[66] *Ala. Power Co. v. U.S. Nuclear Regulatory Comm'n*, 307 F.3d 1300 (11th Cir. 2002).
[67] CBO Testimony at 4.
[68] *Id.*
[69] *Id.*
[70] *Id.* at 5.
[71] Brief of Petitioner National Association of Regulatory Commissioners, *Nat'l Ass'n of Regulatory Comm'rs, et al. v. U.S. Dep't of Energy, et al.,* No. 10-1074, *et al.* (D.C. Cir. July 28, 2010); Brief of Joint Petitioners Nuclear Energy Institute, *et al.*, *Nuclear Energy Inst., et al. v. U.S. Dep't of Energy, et al.*, No. 10-1074, *et al.*, (D.C. Cir. July 28, 2010).
[72] John Kessler, Electric Power Research Inst., Discussion of Commercial Spent Fuel Inventories (2010), *available at* http://www.brc.gov/Transportation_Storage_SC/docs/TS_SC_08-19_mtg/1_EPRI%20Fuel%20Inventories%20Summary.pdf. *See also* Joe T. Carter & Alan J. Luptak, Fuel Cycle Potential Waste Inventory for Disposition at 13 (2010) ("Carter & Luptak").
[73] *See* Kessler, *supra* n.1.
[74] The Atomic Heritage Foundation, The Manhattan Engineering District (2010), *available at* http://www.atomicheritage.org/index.php?option=com_content&task=view&id=295 (last visited Aug. 24, 2010).
[75] Atomic Energy Act of 1946, Pub. L. No. 79-585 (1946).
[76] *Id.* at § 5(a)(2).
[77] *Id.* at § 6(a).

[78] *Id*. at § 9(a).
[79] *See* Alice L. Buck, *A History of the Atomic Energy Comm'n* (1983) U.S. Dep't of Energy, ("Buck") *available at* http://www.atomictraveler.com/HistoryofAEC.pdf (last visited Aug. 24, 2010).
[80] *Id*. at 2.
[81] *Id*. at 2.
[82] AEA § 63-64.
[83] Buck at 3.
[84] 42 U.S.C. § 2073(c)(1).
[85] Energy Reorganization Act of 1974, Pub. L. No. 93-438, 88 Stat. 123 (1974), (codified at 42 U.S.C. § 5801, *et seq*.)
[86] Department of Energy Organization Act, Pub. L. No. 95-91, 91 Stat. 565 (1977) (codified at 42 U.S.C. § 7101).
[87] Note that HLW is a by-product of processing used fuel for the production of nuclear weapons. Status Report 2009 at 23. Used fuel is generated from research associated with nuclear power and the production of nuclear materials for use in nuclear weapons, scientific research, and medicine. *Id*. at 30.
[88] Mixed-waste is waste with radiological components – other than used fuel, TRU, or uranium mill tailings – that is mixed with any waste defined as a hazardous waste under RCRA.
[89] 42 U.S.C. § 6903(27).
[90] FFCA § 102(a)(3).
[91] *Ohio v. U.S. Dep't of Energy* 904 F.2d 1058 (6th Cir. 1990).
[92] *U.S. Dep't of Energy v. Ohio*, 503 U.S. 607 (1992).
[93] Federal Facility Agreements are entered into by DOE, EPA and sometimes the State. They set forth schedules and process for site cleanup under CERCLA, and, often when the State is a party, under RCRA and state hazardous waste law requirements. Status Report 2009 at 67.
[94] Consent Orders, Consent Agreements and Settlement Agreements are legal agreements between DOE, EPA, and the State that document the settlement of a cleanup issue outside of court. Consent Agreements are legally binding, so disputes between signing parties may be taken to court for resolution. *Id*.
[95] A Consent Decree is a court order which reflects an agreement between the parties (usually DOE, EPA and the State). *Id*.
[96] A Site Treatment Plan is a legal agreement developed under the FFCA and RCRA for DOE facilities that set schedules for treatment of the facilities' mixed wastes. *Id*.
[97] *Id*.
[98] *Id*. at 68.
[99] *Id*. at 70.
[100] Second Repository Report at 2.
[101] "Heavy metal" indicates that the weights include only the actual nuclear fuel, not the cladding metal that surrounds the fuel or the metal assemblies in which the fuel rods are contained. The most common heavy metal in used fuel is uranium oxide.
[102] NWPA § 114(d).
[103] Status Report 2009 at 29. DOE's estimate in 2008 was 12,800 MTHM. Second Repository Report at 2.
[104] Status Report 2009 at 29, Second Repository Report at 2.
[105] Second Repository Report at 3.
[106] Status Report 2009 at 30. *See also* Carter & Luptak, at 4-5.
[107] U.S. Dep't of Energy, Energy and Environment: Storage of DOE SNF at Hanford 1 (undated), *available at* http://nsnfp.inel.gov/program/strategymtg/Fact%20sheets/SNF%20storage%20Hanford_final.pdf (last visited Aug. 24, 2010).
[108] U.S. Dep't of Energy, Energy and Environment: Storage of DOE SNF at the Idaho National Laboratory 1 (undated), http://nsnfp.inel.gov/program/strategymtg/Fact%20sheets/INL_factsheet_final.pdf.
[109] *Id*.
[110] *Id*.
[111] *See* Business Wire, "PSCo Reaches Agreement in Principle With DOE" (Nov. 13, 1995), *available at* http://www.thefreelibrary.com/PSCo+reaches+agreement+in+principle+with+DOE.-a017600338; Used Fuel and HLW Overview, *supra* n.2.
[112] *See* U.S. Dep't of Energy, Energy and Environment: Storage of DOE SNF at the Savannah River Site, *available at* http://nsnfp.inel.gov/program/strategymtg/Fact%20Sheets/Storage%20SNF%20at%20SRS_final.pdf (last visited Aug. 24, 2010).

[113] Used Fuel and HLW Overview, *supra* n.2.
[114] *Id*. at 3.
[115] *Id*. at Secs. D.1.a (Naval used fuel), D.2.a (foreign research reactors).
[116] *Batt* Settlement Agreement, *supra* n.12.
[117] *Id*. at Sec. C.1.
[118] *Id*. at Sec. K.2.c.
[119] *Id*. at Sec. K.1.
[120] John McKenzie, Presentation to Blue Ribbon Commission on America's Nuclear Future, Subcomm. on Transportation and Storage, *available at* http://www.brc.gov/pdfFiles/NR_Briefing_100325.pdf .
[121] Agreement Between The Department of Energy and The State of Colorado Regarding the Shipping of Spent Nuclear Fuel Out of Colorado (Feb. 1, 1996). Information about this agreement has been provided by DOE. *See* Dept. of Energy, Office of the Assistant General Counsel for Civilian Nuclear Programs, "Comments on August 31, 2010 (Revised November 12, 2010), Report on 'Federal Commitments Regarding Used Fuel and High-Level Wastes'", *available at* http://www.brc.gov/e-mails/March%2011/Comments_on_Van_Ness_Feldman_Paper_to_BRC_1-24-11.pdf; *see also* Idaho Spent Fuel Management, *supra* n.12.
[122] Used Fuel and HLW Overview, *supra* n.2; *Batt* Settlement Agreement, *supra* n.12; Idaho Spent Fuel Management, *supra* n.12.
[123] *See supra* n.13.
[124] Record of Decision for the Dep't of Energy's Waste Management Program: Storage of High-Level Radioactive Waste, 64 Fed. Reg. 46,661 (Aug. 12, 1999).
[125] 42 U.S.C. § 108.
[126] National Defense Authorization Act for Fiscal Year 2005, Pub. L. No. 108-375 § 3116 (2005).
[127] *Id*. *See, e.g*., Determination Under Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility at the Idaho National Laboratory, 71 Fed. Reg. 68,813 (Nov. 20, 2006).
[128] Used Fuel and HLW Overview, *supra* n.2, at 12.
[129] Status Report 2009 at 23.
[130] *See supra* n.122.
[131] U.S. Dep't of Energy, Order 435.1, *available at* https://www.directives.doe.gov/search?Title=%22DOE+o+435.1%22&Subject:list=status:+current&submit=Search.
[132] Hanford Federal Facility Agreement and Consent Order, As Amended Through July 28, 2010, *available at* http://www.hanford.gov/?page=81. The Tri-Party Agreement, as amended, contains an Action Plan in Attachment 2, which contains a Work Schedule and Designation of Lead Regulatory Agency in Appendix D.
[133] This date was formerly December 31, 2028, but was changed to December 31, 2047 as a result of the consent decree entered into by the parties to the Tri-Party Agreement on October 26, 2010.
[134] U.S. Department of Energy, Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington at S-13, S-23-25, S-39 (Oct. 2009), *available at:* http://www.hanford.gov/files.cfm/EIS-0391_D-Summary.pdf (last visited Nov. 1, 2010).
[135] Status Report 2009 at 24.
[136] *See* Record of Decision: Savannah River Site Salt Processing Alternatives, 66 Fed. Reg. 52,752 (Oct. 9, 2001); Amended Record of Decision: Savannah River Site Salt Processing Alternatives, 71 Fed. Reg. 3,834 (Jan. 17, 2006).
[137] *See* Savannah River Site Approved Site Treatment Plan, 2004 Annual Update Vol. 1 at p. 5-1, WSRC-TR-94-0608, November 2004, *available at* http://sti.srs.gov/fulltext/tr94608r12/tr94608r12.pdf; Amended Record of Decision: Savannah River Site Salt Processing Alternatives, 71 Fed. Reg. 3,834.
[138] Savannah River Site Federal Facility Agreement, dated January 15, 1993, *available at* http://www.em.doe.gov/Pages/compagreements.aspx.
[139] U.S. Department of Energy, Updated Appendices to the Status of Environmental Management Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War at 25 (June 2010) ("Updated Status Report 2010").
[140] Status Report 2009 at 23-24.
[141] Idaho Department of Environmental Quality, Waste at INL: High-Level Waste, http://www.deq.idaho.gov/inl_oversight/waste/high_level.cfm#how_much (last visited Oct. 29, 2010).
[142] Amended Record of Decision: Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement Revised by State 12/21/09, 75 Fed. Reg. 137 (Jan. 4, 2010).

[143] *Id.*.
[144] *Id.*
[145] U.S. Dep't of Energy, Office of Environmental Management, Record of Decision for the Idaho High-Level Waste and Facilities Disposition Final Impact Statement, 70 Fed. Reg. 75,165 (Dec. 19, 2005).
[146] *Id.* at Sec. C.3
[147] *See* West Valley Demonstration Project Waste Management Activities, 70 Fed. Reg. 35,073, 35,074 (June 16, 2005).
[148] *Id.*
[149] *See* Alliance for Nuclear Accountability, Fact Sheet: A Brief History of Reprocessing and Cleanup in West Valley, NY (2007), *available at* http://www.ananuclear.org/Portals/0/documents/08%20History%20of%20Reprocessing%20and%20Cleanup%20in%20West%20Valley,%20NY.pdf.
[150] West Valley Demonstration Project Act of 1980, Pub. L. No. 96-368, 94 Stat. 1347 (1980) (codified at 42 U.S.C. § 2021a (2006)).
[151] *See* West Valley Demonstration Project Waste Management Activities, 70 Fed. Reg. at 35,074.
[152] Used Fuel and HLW Overview, *supra* n.2; *Batt* Settlement Agreement, *supra* n.12; Idaho Spent Fuel Management, *supra* n.12.
[153] *See* Status Report 2009 at 41.
[154] National Research Council Study at 183, n.1.
[155] U.S. Nuclear Regulatory Commission, Backgrounder on Research and Test Reactors, available at http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/research-reactors-bg.html (last visited Aug. 24, 2010).
[156] Record of Decision for the Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, 61 Fed. Reg. 25,092 (May 17, 1996).
[157] *Id.* at 25,092-93.
[158] *Id.* at 25093-94; Finding of No Significant Impact for the Urgent-Relief Acceptance of Foreign Research Reactor Spent Nuclear Fuel, 59 Fed. Reg. 22,829 (May 3, 1994).
[159] *See supra* n.155 at 25,093-94.
[160] Participating high-income countries included Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Israel, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, Taiwan, and the United Kingdom. Other participating countries included Argentina, Bangladesh, Brazil, Chile, Colombia, Greece, Indonesia, Iran, Jamaica, Malaysia, Mexico, Pakistan, Peru, Philippines, Portugal, Romania, Slovenia, South Africa, South Korea, Thailand, Turkey, Uruguay, Venezuela, and Zaire. *Id.* at 25,095-96.
[161] *Id.* at 25,095-96, 99 (extending the May 17, 1996 Record of Decision to May 12, 2016); Revision of the Record of Decision for a Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, 69 Fed. Reg. 69,901 (Dec. 1, 2004). Four categories of fuel would be accepted from foreign research reactors under the policy: (1) used fuel (HEU or LEU) from reactors using LEU fuel or in the process of converting to LEU fuel when the policy became effective; (2) used fuel (HEU or LEU) from reactors that operated on HEU fuel but formally committed to convert to LEU fuel before receipt of fuel into the U.S.; (3) used HEU fuel reactors with lifetime cores that were either planning to shut down while the acceptance policy was in effect or that could not use any available LEU fuels; (4) used fuel (HEU or LEU) from reactors already shut down when the policy went into effect; and (5) unirradiated HEU or LEU from eligible reactors would be accepted as used fuel. *Id.* at 25,096; *see also* Establishment of the Fee Policy for Acceptance of Foreign Research Reactor Spent Nuclear Fuel, 61 Fed. Reg. 26,507 (May 28, 1996) ("Fee Policy").
[162] The ROD was subsequently revised to provide DOE with greater flexibility about the location where it takes title to the waste. By taking title to waste earlier in the transportation process, DOE could obviate the need to purchase insurance for the transportation process for those reactors owned by entities or countries unable to afford the insurance. In those instances, DOE extends Price-Anderson Act coverage to the waste upon taking title. Revised Record of Decision for the Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, 73 Fed. Reg. 50,004, 50,006 (Aug. 25, 2008); Revision to the Record of Decision on the Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactors Spent Nuclear Fuel, 65 Fed. Reg. 44,767 (July 19, 2000) (revised to increase the number of transportation casks allowed per shipment); Revision to the Record of Decision for the Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent

Nuclear Fuel, 61 Fed. Reg. 38,720 (July 25, 1996) (revised to enable DOE to take possession of waste at locations other than the port of entry).
[163] *See supra* n.155 at 25,096; Fee Policy, *supra* n.160, at 26,508. The fee policy was modified slightly in 1999 to clarify the fee policy in the even that a participant country became a high-income economy country. Foreign Research Reactor Spent Nuclear Fuel Policy, 64 Fed. Reg. 18,006 (Apr. 13, 1999).
[164] Revision of the Record of Decision for a Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, 69 Fed. Reg. 69,901 (Dec. 1, 2004).
[165] *Id.* at 69,902.
[166] Total used fuel material estimates are not affected because some countries with material analyzed under the original EIS subsequently elected not to participate in the acceptance program. Revised Record of Decision for the Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, 74 Fed. Reg. 4,173, 4,174 (Jan. 23, 2009).
[167] *See* Part IV.C.2, *infra*, for a description of transportation requirements for this used fuel.
[168] International Atomic Energy Agency, *Research Reactors Database*, http://nucleus.iaea.org/RRDB/RR/ReactorSearch.aspx?rf=1 (last visited Aug. 23. 2010).
[169] U.S. Dep't of Energy, Nuclear Energy, Research Reactor Infrastructure, http://www.nuclear.energy.gov/universityPrograms/neUniversity2c.html (last visited Aug. 23. 2010).
[170] National Research Council Study at 45-46.
[171] NWPA § 137(a)(2) requires that "[t]he Secretary, in providing for the transportation of spent nuclear fuel under this [act] shall utilize by contract private industry to the fullest extent possible…." 42 U.S.C. § 10157(a)(2).
[172] As described above at n. 18, DOE interprets the relevant statutes as granting the agency sole authority over the transportation of used fuel and HLW by the agency. As used herein, the term "transportation" refers broadly to all acts associated with transporting used fuel and HLW from one site to another, a definition that encompasses such related actions as NRC certifications of used fuel and HLW packages, notifications of State and local governments, resolution of disputes over rates and practices with freight railroads by the STB (which has "exclusive" jurisdiction of the same under 49 U.S.C. § 10501(b)), and regulation of the actual transportation by DOT (to whom the freight railroads are subject for safety-related matters)..
[173] National Research Council Study at 259.
[174] Under the Hazardous Materials Transportation Act, DOT has regulatory authority over the shipment of hazardous materials, including radioactive materials, in "intrastate, interstate, and foreign commerce." 49 U.S.C. § 5103; 49 C.F.R. § 171.1. DOE takes the position that this statutory text excludes DOT from authority the transportation of radioactive materials undertaken by DOE on its behalf that is non-commercial in nature. *See* DOE Comments at 4. It is unclear how the distinction between commercial / non-commercial shipments would apply to commercial spent fuel to which DOE takes title to at a commercial reactor site before shipping; any such shipments by DOE could be considered "commercial," given the origin of the used fuel. Further, the Surface Transportation Board, which is nominally part of DOT, has "exclusive" jurisdiction over "transportation" by railroad, 49 U.S.C. § 10501(b), and would be required to adjudicate disputes between DOE and the freight railroads over such matters as rates and service.
[175] Transportation of Radioactive Materials; Memorandum of Understanding, 44 Fed. Reg. 38,690 (July 2, 1979); *see* National Research Council Study at 51.
[176] *Id*.
[177] 49 CFR § 397.101 (2009).
[178] National Research Council Study at 52.
[179] *Id*.
[180] *Id*. at 53.
[181] 49 CFR §173.7 (2009).
[182] National Research Council Study at 53.
[183] *Id*.
[184] *Id.* at 50, n.29.
[185] *Id.* at 50.
[186] Radioactive Material Transportation Practices Manual for use with DOE O 460.2A, U.S. Dept. of Energy Office of Environmental Management 2 (June 4, 2008) ("Transportation Manual").
[187] *Id*.
[188] *Id*.

[189] U.S. Dep't of Energy, Office of Public Affairs, Spent Nuclear Fuel Transportation 6 (undated), *available at* http://www.ustransportcouncil.org/documents/Spent%20Nuclear%20Fuel%20Transporation.pdf ("Spent Nuclear Fuel Transportation").
[190] *Id*.
[191] *Id*. at 11.
[192] *Id.*
[193] *Id.*
[194] *Id.*
[195] U.S. Dep't of Energy, Deputy Assistant Secretary Robert Paduchick, Transportation Briefing 9 (June 17, 2002), *available at* http://www.ustransportcouncil.org/documents/us_transport_briefing.pdf ("Transportation Briefing"); Spent Nuclear Fuel Transportation at 2.
[196] Nuclear Research Council Study at 16.
[197] *Id*. at 54.
[198] *U.S Dep't of Defense and U.S. Dep't of Energy v. Baltimore & Ohio RR, et al.*, 2005 S.T.B. LEXIS 349 (STB 2005).
[199] *Id.*
[200] Transportation Manual at 17.
[201] *Id*.
[202] *Id*.
[203] *Id*. at 50.
[204] Spent Nuclear Fuel Transportation at 2.
[205] U.S. Dep't of Energy, Office of Civilian Radioactive Waste Management, National Transportation Plan DOE/RW-0603 3 (January 2009), *available at* http://www.csgmidwest.org/About/MRMTP/ShipmentPlanning/NTP_Rev0_January2009.pdf ("2009 National Transportation Plan").
[206] National Research Council Study at 117.
[207] *Id*.
[208] Based on shipper notifications required by NRC under regulation 10 CFR Part 73. *Id*. at 118.
[209] U.S. Nuclear Regulatory Commission, Briefing on Office of Nuclear Material Safety and Safeguards Programs, Performance and Future Plans and Integrated Strategy on Spent Fuel Management at 8 (June 25, 2010), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/tr/2010/20100625.pdf.
[210] U.S. Dep't of Energy, Office of Civilian Radioactive Waste Management, Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Mgmt. Program, Fiscal Year 2007 at 2 (July 2008), *available at* http://www.energy.gov/media/Total-Life-Cycle.pdf.
[211] U.S. Dep't of Energy, Office of Civilian Radioactive Waste Management, http://www.energy.gov/environment/ocrwm.htm (last visited August 31, 2010).
[212] 2009 National Transportation Plan at 1.
[213] *Id*. at 1, n.1.
[214] *Id*. at 21.
[215] *Id*. at 2.
[216] *Id*. at 6.
[217] *Id*.
[218] National Research Council Study at 186.
[219] *Id*. at 187.
[220] *Id*. From 1996-2004, 141 packages were transported by rail and only 9 packages were transported by truck. *Id.*
[221] Of the 30 shipments received by 2004, one shipment arrived at the Concord Naval Weapons Station in California, and was transported to INL. Two shipments entered over land through Canada and were sent to SRS. *See* Transportation Briefing at 6; Revision of the Record of Decision for a Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, 69 Fed. Reg. 69,901, 69,902 (Dec. 1, 2004).
[222] Revision of the Record of Decision for a Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, 69 Fed. Reg. at 69,902.
[223] National Research Council Study at 187.
[224] *Id*. at 188.
[225] *Id*. at 188-189.

[226] U.S. Dep't of Energy, EIS-0203F, DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Final Environmental Impact Statement at § 1.1.2.3, *available at* http://nepa.energy.gov/finalEIS-0203.htm.
[227] Id. at § Vol. I, App. D, 4.2.11.
[228] *Id*. at § 4.6.1
[229] *Id*. at § 4.6.2.
[230] Status Report 2009, *supra* n.3, at 33.
[231] *Id*. at 36.
[232] Transportation Briefing at 6, 13.
[233] Status Report 2009, *supra* n.3, at 33.
[234] *Id*. at 34.
[235] U.S. Dep't of Energy, Office of Environmental Management, DOE/EIS-0200F Final Waste Management Programmatic Environmental Impact Statement, *overview available at* http://www.em.doe.gov/stakepages/wmdioverview.aspx.